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PUBLIC COMMENT VERSION

First 5-Year Review
of the Non-Populated Area Operable Unit
Bunker Hill Mining and Metallurgical Complex
Shoshone County, Idaho

Approved by:

Date:

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Executive Summary

Introduction

This report summarizes the initial 5-year review of remedial actions implemented by the Environmental Protection Agency (EPA) Region 10 and the State of Idaho at the Non-Populated Areas operable unit of the Bunker Hill Superfund Site (Site) located in Shoshone County, Northern Idaho. This 5-year review of remedial actions has been prepared to meet the federal statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

At the time of this initial 5-year review, full implementation of the site remedy had not yet been completed. The purpose of this 5-year review is to document the remedial action work conducted to date, and based on information at this time, to assess whether the remedy at the Bunker Hill Superfund site, once completed, will be protective of human health and the environment. Since the time from completion of the implemented remedial actions ranges from months to a couple of years, adequate time has not passed to fully judge the effectiveness of the specific remedial actions. Therefore, this initial 5-year review is not expected to provide final definitive judgements on the effectiveness of the remedies completed at the Site; but rather to be a starting point for ongoing monitoring and evaluation of the overall site remedy.

EPA documents that define the selected remedy for the Non-Populated Areas of the Site include:

- Record of Decision, Bunker Hill Mining and Metallurgical Complex, Shoshone County, Idaho, September 1992.
- Amendment to the Record of Decision for the Bunker Hill Mining and Metallurgical Complex (Non-Populated Areas) Superfund Site, September 3, 1996.
- Explanation of Significant Differences (ESDs) for Revised Remedial Actions at the Bunker Hill Superfund Site, Shoshone County, Idaho: two separate ESDs, January 1996, April 1998.

Brief Site History and Chronology

Commercial mining for lead, zinc, silver, and other metals began at the Site in 1883. Mineral processing and smelting began in the early 1900's and continued until 1981. Over the following decades, the Silver Valley became one of the most important centers of metals mining and processing in the United States. Milling of ore resulted in by-products (tailings) that were routinely disposed in surface waters. In 1910, a plank and pile dam was constructed along the South Fork of the Coeur d'Alene River (SFCDR) at the Pinehurst Narrows to retain the tailings. This retention dam deposited tailings throughout the floodplain of the SFCDR in an area referred to as Smelterville Flats. The dam failed in 1933 resulting is some portion of the tailings spreading downstream. A second tailings repository, the Central Impoundment Area (CIA) was initially constructed in 1928. This tailings impoundment was expanded several times throughout its life as necessary to receive more tailings and other waste materials (eventually to approximately 200 acres in surface area).

Environmental contamination of surface water, groundwater, soil and sediment occurred throughout the valley as a result of the mining, milling, and smelting processes. Vegetation of the surrounding hillsides was gradually denuded from logging, deposition of air-borne metals contamination, and acidification by sulfur compounds. Air-borne emissions affected areas near the Smelter and Zinc Plant as well as the surrounding communities. Over time, blood lead levels of children in the valley reached concentrations well above those considered to be toxic.

In 1983, the federal government listed the site on its National Priorities List. Shortly thereafter, EPA presented various orders to the companies held responsible for the contamination (the Potentially Responsible Parties, PRPs) in an effort to begin remediation of the environmental problems existing on the Site. PRP-supported investigation and cleanup efforts ensued for about 10 years. Their efforts included conducting a Remedial Investigation and Feasibility Study, initial cleanup of the smelter complex, terracing of the denuded hillsides, and some re-vegetation work. EPA issued a Record of Decision (ROD) in 1992 describing the required remedy for the Non-Populated Areas of the Site (which had been delineated as an approximate 21 square mile area).

In 1992 and 1994, two PRPs went bankrupt resulting in EPA and the State of Idaho assuming responsibility for the majority of the Non-Populated Areas cleanup. Five remaining PRPs signed Consent Decrees with EPA and committed to implementing those remedial actions in the Non-Populated Areas of the Site that they agreed to perform. A detailed chronology of site actions and remediations is included in Section 2 of this report.

Responsibilities for Remedy Implementation and Long-Term Operations and Maintenance

In 1994, EPA and the State of Idaho entered into a cost-sharing agreement (as documented in the State Superfund Contract) specific to those areas of the Site that EPA and the State were performing remedial actions. These areas include:

- Hillsides,
- Gulches (Grouse, Government, Magnet, and Deadwood),
- Smelterville Flats, north and south of Interstate 90,
- Central Impoundment Area,
- Industrial Complex (Lead Smelter, Zinc Plant, Phosphoric Acid Plant),
- Boulevard Area and Railroad Gulch,
- Mine Operations Area,
- Central Treatment Plant,
- Bunker Creek, and
- Milo Creek and Reed Landing.

For these same areas, based on the requirements of CERCLA, the State of Idaho will be responsible for 100-percent of long-term operations and maintenance (O&M).

The five remaining PRPs (Union Pacific Railroad (UPRR), Stauffer Chemical, Hecla, Sunshine Mining, and ASARCO) signed Consent Decrees with EPA and committed to implementing and conducting long-term O&M for those Non-Populated Areas' remedial actions that they agreed to perform. PRP-implemented remedial actions include:

- Remediation of UPRR right-of-way through the Site – UPRR,
- Closure of A-4 Gypsum Pond – Stauffer Chemical, and
- Page Pond remediation – Hecla, Sunshine, and ASARCO.

For the portion of the site which EPA and the State are performing the cleanup actions, a two-phased implementation strategy was agreed upon as documented in the State Superfund Contract. Phase I work (reviewed in this initial 5-year review document) includes source removals aimed at removing and consolidating extensive contamination from various site areas, demolition of structures, development and implementation of an Institutional Controls Program (ICP), future land use development, and public health response actions. Phase I work also includes support studies for long-term water quality improvement. Phase I was expected to last approximately 8 years (1995 through 2002).

Phase II will be implemented following completion of source control and removal activities and evaluation of the effectiveness of these activities in meeting water quality improvement objectives. This phase will consider any shortcomings encountered in implementing Phase I and will specifically address long-term water quality, ecological, and environmental management issues.

ROD Requirements

The selected remedy documented in the 1992 Non-Populated Areas ROD addresses both human health and ecological aspects of the Non-Populated Areas of the Bunker Hill site through the following general objectives:

- Minimize direct human contact with contaminants.
- Reduce erosion of the hillsides.
- Minimize windblown dust from contaminated areas.
- Reduce suspended sediment and contaminant loading in surface water runoff to the SFCDR.
- Minimize migration of contaminants to groundwater.
- Consolidate contaminated material removed during remedial actions in on-site repositories and close these areas with engineered covers to reduce infiltration.

In addition to these general objectives, the remedy selected in the ROD is required to comply with federal and state standards that are applicable or relevant and appropriate requirements (ARARs). As part of this initial 5-year review, the ARARs identified in the 1992 Non-Populated Areas ROD were reviewed and any changes or newly promulgated standards were identified and summarized (Appendix B). Section 5.1 of this report summarizes five revisions to existing ARARs or to be considered (TBC) documents initially identified in the ROD, and two newly identified regulations of TBCs. These revisions and newly identified regulations or TBCs do not affect the protectiveness of the remedy selected in the 1992 ROD.

Remedy Description

The selected remedy was designed to achieve the ROD objectives through a series of source removals, surface capping, reconstruction of surface water creeks, demolition of abandoned milling and processing facilities, engineered closures for waste consolidated on-site, and re-vegetation efforts.

A brief description of each remedial action that is part of the overall site remedy is summarized in Table ES-1. More detailed descriptions of the various remedial actions and the specific ROD requirements that apply to each action are presented in Section 4 of this report.

Table ES-1

Summary of Remedial Action Descriptions

Remedial Action	General Description of Remedial Action
Implemented by EPA and State of Idaho	
Hillsides	Reduce erosion, increase infiltration, and minimize direct contact by contouring, terracing, and re-vegetating hillsides areas that are essentially denuded. Provide surface armor or soil cover on mine waste rock dumps and remove solid waste landfills to on-site consolidation areas.
Gulches (Grouse, Government, Magnet, and Deadwood)	Reduce erosion, minimize direct contact, and minimize migration of contaminants to surface and groundwater by constructing erosion control structures and sediment basins, removing contaminated soils above cleanup levels, relocating the A-1 Gypsum Pond from Magnet Gulch to the CIA, reconstructing Government and Magnet Creeks, and installing surface barriers consistent with future land use.
Smelterville Flats (north and south of Interstate 90)	Minimize direct contact, surface water erosion, and migration of contaminants to surface and groundwater by conducting extensive tailings removals throughout the floodplain, depositing removed tailings on the CIA, reconstructing portions of the SFCDR, providing soil barriers and re-vegetation as necessary. Construct storm drain/swale conveyance system for surface water generated south of I-90 highway.

Table ES-1

Summary of Remedial Action Descriptions

Central Impoundment Area	Minimize dust dispersion, direct contact, and infiltration through underlying contaminated materials by closing the impoundment with an engineered cover of permeability 1 x 10-7 cm/sec or less. Minimize seepage to the SFCDR by intercepting the CIA seeps located on the north side of the CIA.
Industrial Complex (Lead Smelter, Zinc Plant, Phosphoric Acid Plant)	Minimize dust dispersion, direct contact, and potential for migration to surface and groundwater; remove safety hazards of abandoned facilities by recycling or consolidating principal threat materials in a fully lined and covered monocell, removing PCB transformers and PCB-contaminated soils, removing asbestos material, demolishing structures and consolidating debris in Smelter Closure area, consolidating contaminated soil and slag from site removals in Smelter Closure area, demolishing 4 stacks in Smelter and Zinc Plant, and constructing an engineered cover over the closure area with a permeability of 1x10-7 cm/sec or less.
Mine Operations and Boulevard Area, Railroad Gulch	Minimize direct contact, infiltration through contaminated material, and erosion by demolishing structures, removing contaminated soils to cleanup levels and disposing in the Smelter Closure area, removing principal threat materials and recycling or disposing in the Smelter Closure, capping and re-vegetating disturbed areas, and reconstructing Railroad Gulch Creek to increase surface water flow capacity.
Central Treatment Plant	Treat acid mine drainage and contaminated site surface waters to current NPDES discharge standards and dispose of resulting sludge on top of the CIA. These actions are considered interim measures. EPA and the State are presently evaluating acid mine drainage issues and long-term treatment issues for the Site. A separate ROD documenting the evaluations and remedy selection process is anticipated to be issued in 2001.
Bunker Creek	Minimize infiltration through contaminated soil, contaminated sediment releases to surface water, and direct contact by channelizing and reconstructing Bunker Creek, removing contaminated surface soil to cleanup levels, and capping and re-vegetating disturbed areas.

Table ES-1 Summary of Remedial Action Descriptions	
Milo Creek and Reed Landing	Minimize sediment transport into Milo Creek from adjacent tailings and waste rock dumps and surface water infiltration into the underlying Bunker Hill mine workings by lining the creek (pipe the flow) and removing contaminated sources adjacent to the Creek as practicable.
Implemented by PRPs	
Page Pond	Minimize fugitive dust, direct contact and contaminant releases to surface and groundwater by removing tailings from the West Page Swamp, regrading, capping, and re-vegetating the Page Pond impoundment and dikes, diverting/modifying surface water channels into the swamp areas, providing hydraulic controls to enhance wetlands, and inundating remaining tailings.
Union Pacific Railroad Rights-of-Way	Minimize fugitive dust and direct contact by "hot spot" removals, soil/rock barriers, and re-vegetation.
A-4 Gypsum Pond Closure	Minimize dust dispersion and seepage from the impoundment by placing a soil barrier, regrading, and re-vegetating the surface of the Pond and providing a stable channel for Magnet Creek flow across the A-4 Pond to Bunker Creek.

Monitoring Programs

The ROD requires periodic monitoring of soil, water and air at the Bunker Hill Superfund site to provide information about the changing nature and extent of contamination of various media. ROD-stated objectives of monitoring are:

- To evaluate compliance with ARARs in surface water and groundwater,
- To assess the status of environmental receptors (i.e., biological monitoring),
- To evaluate the performance of specific remedial actions and their respective O&M programs,
- To evaluate success in meeting public health protection goals (i.e., continuation of blood lead screening program),
- To evaluate the adequacy of control measures instituted during the implementation of remedial actions, and
- To evaluate the success of remedial actions in protecting human health and the environment and determine the adequacy of remedial actions selected in the ROD.

Monitoring is also used in conjunction with design to meet the objectives of the ROD. Surface water, groundwater, and air monitoring at the Bunker Hill Superfund Site is being performed in three different programs:

- The Site-Wide Surface Water, Groundwater and Air Monitoring Program
- The Hillsides Monitoring Program
- The Smelter Observational Approach Monitoring Program

These programs are described in Section 4 of this report.

The three monitoring programs will continue to be conducted, with annual reports prepared to document trends observed. The site-wide monitoring program was initially developed during the remedial investigation phase of the project (late 1980's) and was initially planned to evaluate the general nature and extent of contamination throughout the site. This site-wide monitoring program has been modified over the years for the purposes of tracking site-wide trends as well as gathering needed remedial design data. Now that the remedial designs and remedial actions are nearly complete, the site-wide monitoring program (primarily surface and groundwater) will be re-evaluated and modified as necessary to ensure that appropriate data are gathered to address remedial actions that have been designed and implemented across the Site.

Biological monitoring of wildlife is currently being planned under an inter-agency agreement between EPA and the U.S. Fish and Wildlife Service. This monitoring is expected to begin in 2000. A description of the biological monitoring program and any results obtained from this program will be addressed in a future 5-year review report.

Assessment of Remedial Actions

Table ES-2 provides a summary of this initial 5-year assessment for the Non-Populated Areas of the Site. Included in the table are dates during which particular activities or remedial actions were conducted, work that is remaining to complete the remedial action, a general assessment of the performance or protectiveness of the remedy, and any deficiencies noted during this 5-year review. This same table is repeated in the text of this 5-year report in Section 5 as Table 5-1.

Table ES-2
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Activity				
ICP Program within Non-Populated Areas	1994 - present	As part of individual RAs, placement of ICP barriers and fences at various Site locations	As has been conducted to date, EPA, IDEQ, and USACE will continue to provide oversight of ICP-related work in the Non-Populated Area of the Site	None noted.
Health and Safety During Remediations	1994 - present	Ongoing	Successful implementation of safety programs as evidenced by no lost time or injuries reported for prime contractor	None noted.
Operations and Maintenance of Remedies	1994 - present	Day-to-day O&M currently provided by subcontractors to USACE.	O&M being performed adequately.	None noted.
	1999 - 2000	IDEQ in process of preparing Site-Wide O&M Plans	Not applicable (NA)	NA
Site-Wide Monitoring	1987 - 1993 1996-present	Ongoing monthly and quarterly programs, yearly trend analysis reports	Insufficient data exists at this time to establish trends between data and effectiveness of remedies.	None noted.

Table ES-2
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Hillsides Monitoring Program	1999 - present	Ongoing monitoring, annual reports and workshops to discuss data modifications to RA approach, if necessary	Adaptive management approach working adequately.	None noted.
Smelter Closure Observational Approach	1997 - present	Ongoing monthly sampling, yearly trend analysis reports	As expected, insufficient amount of post-remediation data to conclusively determine trends at this time.	None noted.
Remedial Action				
Hillsides RA	1990 – 1994 (PRPs)	NA	Terracing was effective. Planting was marginally effective.	None noted.
	1996 – present (Fund-lead)	Re-vegetation programs planned through 2001, adaptive management afterwards. Upper Industrial Landfill yet to be removed.	Adaptive management approach working adequately. Raveling hillslopes above Smelterville and Wardner residential areas may need additional monitoring and/or cleanout to reduce potential for recontamination.	None noted.

Table ES-2
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Gulches RA	Grouse: 1997	None noted.	All Gulches:	
	Gov't: 1996-1998	Lower Gov't Creek re-alignment. Riparian planting.	Access control throughout gulches and hillsides should be evaluated to determine appropriate level of concern (i.e., trail bikers have been reported to use Grouse Gulch for recreation).	Determine need for access restriction and if current access is deficient implement greater controls.
	Magnet: 1995-1998	Magnet Creek channel through A-4 gypsum pond.		
	Deadwood: 1995 – 1998	Riparian planting.	Remedies are performing as expected. Creek channels are expected to become more stable with time.	None identified.
Smelterville Flats RA	1996 – 1998	Plantings in Flats area. Re-capping of Truck Stop area. South of I-90 storm drain and ICP capping. Special Area Management Plan as prepared by State of Idaho	Remedy is performing adequately. Channel of SFCDR is expected to become more stable with time.	Truck portion of RV Park needs to be re-capped to prevent direct contact and dispersion of dust.
	1999 - present	East of Theater Bridge tailings removals and capping		

Table ES-2
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Central Impoundment RA	1995 – present	Final closure to be completed in 2000. Ongoing monitoring of CIA seeps.	No assessment at this time; remedy is only partially complete	None at this time.
Page Pond RA	1997 - present	Majority of RA yet to be completed: Tailings removal, placement of clean fill, modifications to South and North Channels, construction of outlet and discharge structures to SFCDR, construction of internal berms in West Swamp.	No assessment at this time; remedy is only partially complete	PRP program for baseline and routine groundwater and surface water monitoring was reviewed by EPA and found to be deficient. PRPs are required to revise program and re-submit for EPA and State review.
Industrial Complex RA	1995 – 1998 Construction season 2000	Borrow Area/ICP Landfill construction. Ongoing monthly monitoring of groundwater wells as part of observational approach.	Remedy is performing adequately.	None noted.
Mine Operations Area RA	1994	None noted.	Remedy is performing adequately.	None noted.
Boulevard RA	1997	None noted.	Remedy is performing adequately.	None noted.

Table ES-2
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Railroad Gulch RA	1997	None noted.	Remedy is performing adequately.	None noted.
Central Treatment Plant RA	1994 - present	Ongoing O&M	Remedy is performing adequately.	None noted.
Bunker Creek	1996 - 1997	ICP capping on west end of Bunker Creek project area. Emergency overflow channel to Gov't Creek.	Remedy is performing adequately. Protectiveness from direct contact is not yet achieved until all areas receive ICP cap.	None noted.
UP Railroad RA	1995 - 1999	A portion of the UPRR right-of-way used as a haul road remains to be remediated by EPA.	Remedy is performing adequately; verification sampling indicated that none of the sampled areas exceeded 1,000-mg/kg lead. 1999 Sampling Report did indicate that 7 areas sampled did not have the required thickness of ICP barrier.	Increasing barrier thickness in some locations is warranted as indicated by 1999 sampling.
Milo Creek and Reed Landing RA	1995 - 2000	None noted.	Remedy appears to be performing adequately, however, much of the remedy has been constructed in last 2 years and will require more time to determine effectiveness and protectiveness.	None noted.

Recommendations and Required Actions

As part of this 5-year review, recommendations and required actions were identified to improve remedy performance or protectiveness in alignment with the Remedial Action Objectives and performance standards of the Site. Section 5, Table 5-2 of this 5-year review summarizes the specific recommendations and required actions that have been identified for the various monitoring activities and remedial actions. Also identified in Table 5-2 are parties responsible for implementation and oversight, proposed completion milestone dates, and the potential to affect protectiveness of the remedy.

Recommendations and required actions resulting from this initial 5-year review include:

- Evaluate the need for additional efforts to encourage vegetative growth at the Page Mine Waste Rock Dump.
- Evaluate the need for an Explanation of Significant Differences or ROD Amendment to address groundwater control and collection systems and creek lining in Government Gulch.
- Evaluate the site-wide monitoring program to confirm that appropriate data is being gathered to assess remedy performance across the Site.
- Evaluate the need for an Explanation of Significant Differences or ROD Amendment to address the adaptive management approach adopted for the hillsides remedial action.
- Inspect catchment walls at the base of Smelterville and Wardner hillsides to determine if additional action is necessary to prevent recontamination.
- Assess the need for additional access controls to hillsides and gulches.
- Develop and implement operations and maintenance procedures for all remedial actions, including measures to address recontamination potential.
- Conduct yearly surveys of gulch remedial actions to evaluate channel and surface barrier stability, success of vegetation, and surface water and groundwater quality.
- Develop and implement a biological monitoring program for the Site.
- Clean out sediment from the bottom of the Lined Pond.
- Evaluate the Union Pacific Railroad right-of-way to determine if all segments meet thickness requirements.
- Evaluate the need to cover mine waste and tailings disposed in the Milo Creek Guy Caves area with clean material.
- Evaluate the need for an Explanation of Significant Differences or ROD Amendment to address increased tailings removal on the Flats and the decision to defer construction of the groundwater and surface water wetland treatment systems.

- Evaluate the need for an Explanation of Significant Differences or ROD Amendment to address the deferment of construction of a seep collection system at the Central Impoundment Area.

Statement of Protectiveness

Overall, the remedy being implemented in the Non-Populated Area operable unit of the Bunker Hill Superfund Site is expected to be protective of human health and the environment upon completion, provided that the recommendations identified above are implemented. Although the remedy hasn't been fully implemented, immediate threats to human health and the environment have been addressed by source removal efforts, capping activities, erosion control measures, ongoing treatment of mine water, and institutional controls. The site requires ongoing reviews.

Next 5-Year Review

Statutory requirements of CERCLA require ongoing 5-year reviews for Superfund sites once remediations have been initiated. The next review will be conducted within 5 years of the completion date of this 5-year review report. The completion date is the date of the signature shown on the cover of this report. This subsequent review will cover all remedial work, monitoring, and O&M activities conducted at the Site. This subsequent 5-year report is expected to summarize more detailed information on protectiveness of the remedy since five additional years of monitoring data and annual remedy inspection reports will then be available to judge remedy performance.

Contents

Page

Figures

Tables

Acronyms

Administrative Orders on Consent (AOC)
American Conference of Governmental Industrial Hygienists (ACGIH)
Applicable or Relevant and Appropriate Requirements (ARARs)
Best Demonstrated Available Technology (BDAT)
Bunker Limited Partnership (BLP)
Center for Disease Control's (CDC)
Central Impoundment Area (CIA)
Central Treatment Plant (CTP)
Code of Federal Regulations (CFR)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Environmental Protection Agency (EPA)
Explanation of Significant Difference (ESD)
Feasibility Study (FS)
Federal Water Quality Criteria (FWQC)
Health and Safety (H&S)
Idaho Department of Environmental (IDEQ)
Institutional Controls Program (ICP)
micrograms per cubic meter ($\mu g/m^3$)
micrograms per deciliter ($\mu g/dL$)
micrograms per liter (ug/L)
milligrams per kilogram (mg/kg)
Mine Operations Area (MOA)
Minimum Contaminant Level (MCL)
Morrison-Knudsen (MK)
National Contingency Plan (NCP)
National Priority List (NPL)
Natural Resource Defense Act (NRDA)
Operation and Maintenance (O&M)
Page Pond Wastewater Treatment Plant (PPWTP)
Panhandle Health District (PHD)
Preliminary remediation goals (PRGs)
Principle Responsible Parties (PRPs)
Quality Assurance and Quality Control (QA/QC)
Record of Decision (ROD)
Remedial Actions (RA)
Remedial Action Objectives (RAOs)
Remedial Design (RD)
Remedial Investigations (RI)
Remedial Investigation and Feasibility Study (RI/FS)
Removal Verification Team (RVT)
Resource Conservation and Recovery Act (RCRA)
Rights-of-Way (ROWs)

Safe Drinking Water Act (SDWA)
South Fork of the Coeur d'Alene River (SFCDR)
State Superfund Contract (SSC)
Threshold Limit Values (TLVs)
to be considered (TBC)
Total Maximum Daily Load (TMDL)
Toxic Substance Control Act (TSCA)
Total suspended solids (TSS)
Union Pacific Railroad (UPRR)
U.S. Army Corps of Engineers (USACE)
U.S. Bureau of Land Management (US BLM)
Washington State University (WSU)

1.0 Introduction

The Environmental Protection Agency (EPA) Region 10 has conducted the first 5-year review of the remedial actions implemented at the Bunker Hill Superfund site (Site) located in Shoshone County, Northern Idaho. The Site is divided into two operable units, the Populated Areas and the Non-Populated Areas. This 5-year review addresses the Non-Populated Area review and was conducted from January through June 2000. The Populated Area is addressed in a separate 5-year review document.

1.1 Statutory Requirements

The Record of Decision (ROD) for the Non-Populated Areas of the Bunker Hill Superfund site was signed in 1992 (EPA, September 1992). The selected remedy addressed both human health and ecological impacts to the Non-Populated Areas. Remedial designs and implementation of the selected site remedy was begun in 1994.

This 5-year review of remedial actions in the Non-Populated Areas of the Bunker Hill site was conducted to meet federal statutory requirements. Hazardous substances in the Non-Populated Area of the Bunker Hill Superfund site are being addressed in accordance with the requirements of the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), as amended, and the National Contingency Plan (NCP) Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR).

The methods, findings, and conclusions of the review are documented in this initial 5-year review report. In addition, this report summarizes deficiencies found during the review and provides recommendations to address them.

This is the first 5-year review for the Non-Populated Area of the Bunker Hill Superfund site. Remedial actions at the Site were initiated in the Fall of 1994. Since some of the remedial actions performed or planned in the Non-Populated Area at the Bunker Hill site have resulted or will result in hazardous substances remaining at the Site that will restrict future uses, a 5-year review of the Bunker Hill site must be completed to meet statutory requirements.

1.2 Purpose of 5-Year Review

1.2.1 General

The purpose of 5-year reviews on Superfund sites is to evaluate whether the selected remedial actions are protective of human health and the environment. For remedial actions that have not been completed, the 5-year review will determine if immediate threats have been addressed and if remedies will be protective when remedial actions are complete. The main purpose of the 5-year review is not to reconsider decisions made during selection of remedies, but to evaluate the implementation and performance of remedies. However, in some situations, the 5-year review contains recommendations that remedies be re-evaluated or that additional response actions be considered. Examples of situations that might result in re-evaluation of remedies or consideration of additional response actions include finding that a remedy will not adequately reduce levels of a contaminant of concern or finding that a new contaminant, source, or pathway of exposure has been identified or has not been sufficiently addressed. Where necessary, the 5-year review report will include recommendations to improve the protectiveness of the remedy and address deficiencies identified during the review.

1.2.2 Specific to Bunker Hill

As noted in Section 1.1, implementation of select remedial actions at the Non-Populated Areas Bunker Hill site was begun in 1994. When remedial actions were initiated, it was projected that full implementation and completion of all required remedial actions would take place over a period of 10 or more years. Currently after 5 years, while many remedial actions have been completed, several additional remedial actions are either in the design phase, or are being implemented and are partially complete. In addition, many of the remedial actions have only recently been completed. As such, their time from completion may range from months to a couple of years, and adequate time may not have passed to judge the effectiveness of the specific remedial action.

Based on the staged implementation and completion of the site remedial actions, this initial 5-year review is not expected to provide final definitive judgements on the effectiveness of the remedies completed at the Site; but rather to be a starting point for ongoing monitoring and evaluation of the overall site remedy. A chronology of the Site that includes the staged implementation of remedial actions is shown in Section 2..A schedule for future 5-year reviews is summarized in Section 7.

1.2.3 5-Year Review Process

This 5-year review consisted of a review of relevant documents and interviews with various individuals familiar with specific remedial activities. The report was reviewed by representatives of the EPA, the U.S. Army Corps of Engineers, the State of Idaho Division of Environmental Quality (DEQ), the Panhandle Health District, contractors for EPA and DEQ, and various representatives of the federal and state natural resource trustees including the U.S. Department of Interior, U.S. Department of Agriculture, the Coeur d'Alene Tribe, and Idaho Fish and Game. The federal and state natural resource trustees have participated in the remedial investigation, feasibility study, remedy selection, and remedial action processes for the Bunker Hill Superfund site. General notification was made of the upcoming review in fact sheets and at Bunker Hill Superfund Site Task Force meetings. The Cities of Wardner, Smelterville, Pinehurst and Kellogg were advised of the upcoming review, as well as the Shoshone County Commissioners. In addition, a draft annotated outline of the 5-year review report was submitted for comment to the Bunker Hill Superfund Task Force, federal and state natural resource trustees, and the Peoples Action Coalition. A fact sheet announcing the draft findings of the 5-year review process and the availability of the draft document for public review and comment was issued, and a public meeting was held to discuss the draft findings of the 5-year review report. The public comment period was held for 45 days.

1.3 Relevant Guidance Documents

EPA has issued a draft guidance document titled *Draft Comprehensive 5-Year Review Guidance* (EPA, October 1999) that was used for the preparation of this 5-year review. A process for the review was developed in accordance with EPA guidance and site-specific conditions at the Bunker Hill site. The following steps were conducted to provide the summaries, evaluations, and recommendations for this report:

1. Description of the work area or remedial action with a brief presentation of background information,
2. Review of remedies selected in the ROD as amended or modified and identification of performance standards and cleanup goals,
3. Description of work that has been performed and remains to be completed,
4. Discussion of Operation and Maintenance (O&M) considerations,
5. Assessment of remedy performance and conformance with ROD requirements, discussion of newly identified information, and discussion of identified deficiencies and recommended improvements, and
6. Description of documents reviewed and interviews completed for the review.

The conclusions of the review are summarized in this report with recommendations for future actions to be taken at the Site, a statement of the level of protectiveness of ongoing remedies, and a schedule for the next 5-year review.

Since the ROD was issued in 1992, various changes have occurred in the general approach of implementing the selected remedy. A general shift towards increased source removals across the Site (versus approaches that relied on a greater degree of long-term operations and maintenance) was adopted by EPA and the State of Idaho, as documented in the Comprehensive Cleanup Plan which is appended to the State Superfund Contract (State of Idaho, 1995). Per CERCLA, remedy changes are required to be formally documented either in an amendment to the ROD or in a document referred to as an Explanation of Significant Differences (ESD). For the Bunker Hill Site, there has been one ROD amendment and two ESDs prepared since the ROD was issued in 1992. The rationale for the remedy changes is noted in this 5-year review document. Other potential changes to the remedy that may require future ESDs or ROD amendments are identified and discussed later in this document.

Current EPA documents that define the selected remedy for the Non-Populated Areas of the Site include:

- Record of Decision, Bunker Hill Mining and Metallurgical Complex, Shoshone County, Idaho, September 1992.
- Amendment to the Record of Decision for the Bunker Hill Mining and Metallurgical Complex (Non-Populated Areas) Superfund Site, September 3, 1996.

- Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site, Shoshone County, Idaho: two separate ESDs, January 1996, April 1998.

1.4 Rationale for Separate 5-Year Reviews

When work first began in the early 1980's on investigation of the Bunker Hill area, elevated levels of lead were found in the blood of children residing in the Populated Areas of the Site. Because of the elevated blood lead levels, remediation of the Populated Areas of the Site was given a higher priority over remediation of the Non-Populated Areas. A separate remedial investigation and feasibility study (RI/FS), and a residential soil ROD (EPA, August 1991) were completed to allow accelerated cleanup of the Populated Areas.

Separate 5-year reviews corresponding with the two separate RODs have been conducted for the populated and Non-Populated Areas (operable units) of the Bunker Hill site. These operable units have been managed as separate efforts throughout the study and cleanup process. The decision by EPA to prepare separate 5-year reviews conforms with previous decisions to conduct separate RI/FSs and prepare separate RODs for the populated and Non-Populated Areas of the Bunker Hill site and reflects the different types of cleanup activities carried out in these areas.

2.0 Site Chronology

Commercial mining for lead, zinc, silver, and other metals first began in the Coeur d'Alene mining district in 1883. Over the following decades, the Silver Valley progressed to become one of the most important centers of metals mining and processing in the U.S. One ramification of this distinction, however, was the environmental contamination that resulted from these activities. At one point, industrial output associated with the Bunker Hill Mine alone peaked at over 2,500 tons of processed ore per day. In the meantime, groundwater became heavily contaminated with metallic compounds with potentially detrimental human health effects: lead, cadmium, mercury, arsenic, and others. Milling by-products, rich in metals, were deposited on the floodplains of both major and minor drainages of the valley. The vegetation of surrounding hillsides was gradually denuded from logging, fires, deposition of air-borne metals, and acidification by sulfur compounds. Over time, blood lead levels of children in the valley reached concentrations well above those considered to be toxic leading to substantial health concerns.

Smelting activities in the complex ceased in 1981. Two years later, in 1983, the federal government became formally involved with the cleanup of the Site when it listed the area on its National Priority List (NPL). Shortly thereafter, EPA presented various orders to the companies held responsible for the contamination (the Potentially Responsible Parties, PRPs) in an effort to begin remediation of the environmental problems existing on the Site. PRP-supported cleanup efforts ensued for about 10 years. Their efforts included funding of numerous studies, initial cleanup of the smelter complex, terracing of the denuded hillsides, and some re-vegetation work. However between 1992 and 1994, two PRPs went bankrupt. As a result, EPA and the State of Idaho performed cleanup of those areas of the site that the remaining PRPs would not agreed to perform. Consent Decrees for the cleanup work that the remaining PRPs agreed to perform were signed and that work has also been implemented.

A detailed listing of the chronology of the Site is shown in Figure 1.

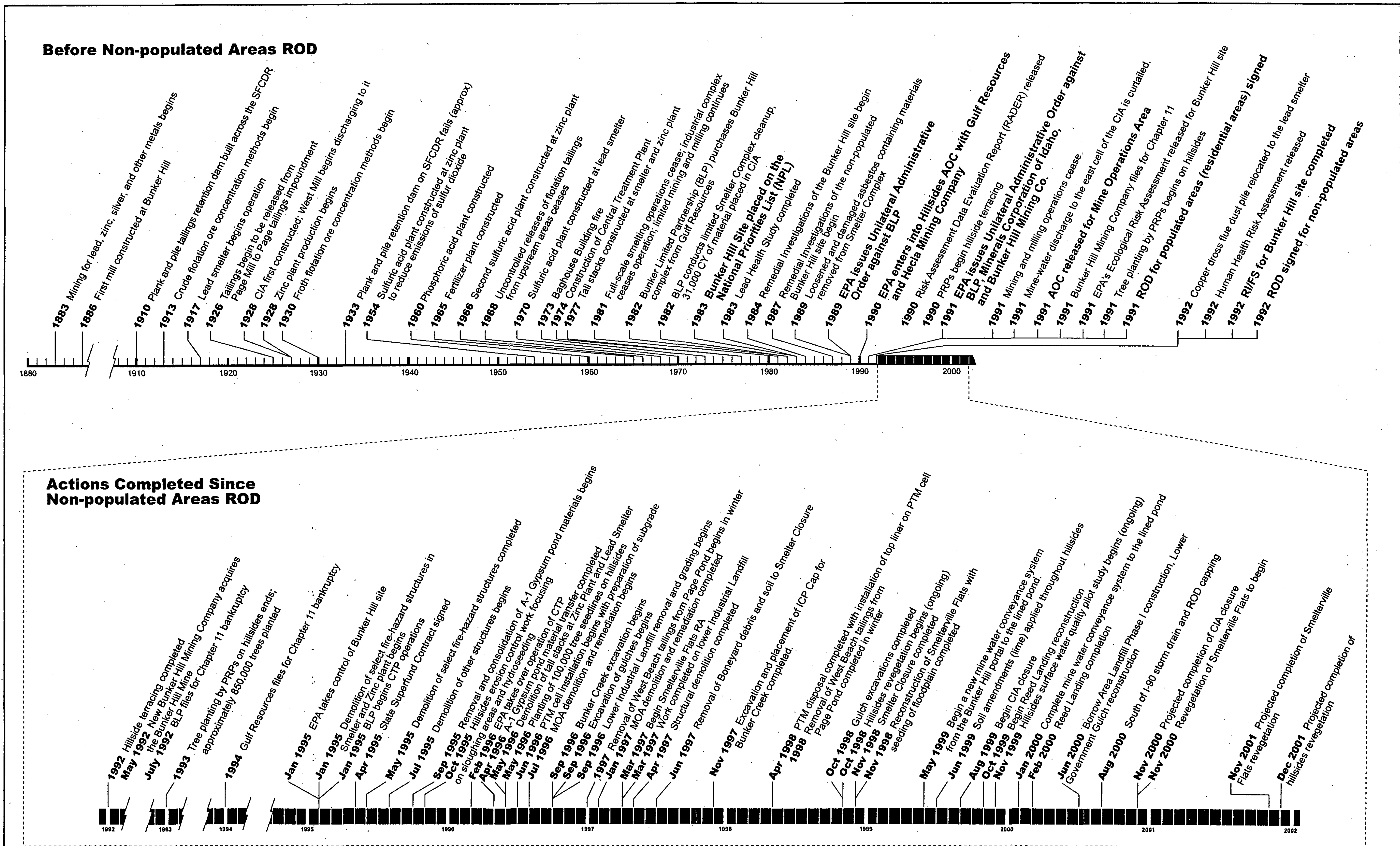

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Figure 1
Site Chronology
BUNKER HILL NON-POPULATED AREAS INITIAL 5-YEAR REVIEW

3.0 Background

3.1 Site Location, Description, and Characteristics

The Bunker Hill Mining and Metallurgical Complex Superfund Site (Figure 2) is located in Shoshone County, in northern Idaho. The Site lies in the Silver Valley of the South Fork of the Coeur d'Alene River (SFCDR). Figure 2 shows a site map identifying the key features of the Bunker Hill site. The Silver Valley is a steep mountain valley that trends from east to west. It has an average elevation of approximately 2,250 feet above mean sea level (MSL) at the base of the valley and extends to approximately 4,500 feet MSL in the upper Milo Gulch area. Interstate 90 bisects the Site east to west and parallels the SFCDR.

The Site is approximately 21 square miles in size, and has been impacted by over 100 years of mining and 65 years of smelting activities. This has resulted in widespread contamination of the Site with metals from a variety of sources. Contamination of soils, surface and ground water, and air has occurred to varying degrees.

Further description of the physical and cultural setting of the Site can be found in the RODs for the Non-Populated and Populated Areas of the Site (EPA, September 1992; EPA, August 1991).

3.2 Site History

The Bunker Hill site has a history of mining and metallurgy that spans approximately 100 years. Mining first began in the area during the mid-1880s. While various ore concentration methods were employed at the Site prior to this time, actual smelting of ore did not begin until 1917 when the Lead Smelter began operations. Zinc smelting began in 1928. Milling of ore resulted in by-products (tailings) that were routinely disposed in surface waters. This type of disposal in surface waters occurred in both the Bunker Hill site and upstream milling sites as well. In 1910, a plank and pile dam was constructed along the SFCDR at the Pinehurst Narrows (Figure 2) to retain the tailings. This dam resulted in tailings being deposited in the current floodplain of the SFCDR or Smelterville Flats area. The dam failed in 1933 resulting in some portion of the tailings being spread downstream of Pinehurst Narrows. Other tailings impoundments at the Bunker Hill site included Page Pond, built in 1926, and the Central Impoundment Area (CIA), constructed in 1928 (Figure 2).

From the time of initiation of smelting through the 1960s, the Bunker Hill site was dominated by industrial activity. Mining and the production of lead, zinc, silver, sulfuric and phosphoric acids, and fertilizer were the primary activities occurring in the area. Ultimately, milling capacity at the Site reached 2,500 tons per day. The 1970s began an era of increased environmental concern about the Site. A 1973 fire in the baghouse of the Lead Smelter stack led to increased emissions of lead particulates into the environment. This, in turn, led to studies showing significantly increased blood lead levels in children living in the immediate area. Subsequent actions taken during the latter 1970s resulted in at least partial reduction in blood lead levels. Also, in 1977, tall stacks were constructed on the Site to help disperse sulfur dioxide from the Site.

The decade of the 1980s was one of official recognition by the federal government of the Bunker Hill Mining and Metallurgy Complex as an environmentally contaminated area. Initial studies focused on gathering data to understand the nature and extent of contamination along with some initial remedial work. The Site was placed on the National Priority List (NPL) in 1983. This year marked both the beginning of EPA presence in the Silver Valley and the initiation of CERCLA activities at the Site. Various studies examined both Populated and Non-Populated Areas of the Site and served to understand the range of contamination as well as the assignment of liability associated with it.

The 1990s ushered in a number of environmental decision documents and the beginning of EPA-directed cleanup work. Two RODs, one for the Populated Areas of the Site (Residential Soil ROD) and one for the Non-Populated Areas, were released in 1991 and 1992, respectively. In addition, three Administrative Orders on Consent (AOC) were issued by EPA from 1990 to 1992 to the Site's PRPs directing work on the hillsides, the Mine Operations Area (MOA), and elsewhere.

With the 1992 bankruptcy of one of the Site's PRPs (the Bunker Limited Partnership) and the subsequent bankruptcy of the Site's major PRP (Gulf Resources) in 1994, EPA took control of the Site in 1995 and entered into a contractual agreement with the State of Idaho (Idaho Division of Environmental Quality (IDEQ) to jointly implement the majority of the ROD-specified remedial actions for the Non-Populated Areas of the Site (IDEQ, May 1995). Five remaining PRPs (Union Pacific Railroad (UPRR), Stauffer Chemical, Hecla, Sunshine Mining, and ASARCO) signed Consent Decrees with EPA and committed to implementing those Non-Populated Areas' remedial actions that they agreed to perform. PRP-implemented remedial actions include:

- Remediation of UPRR right-of-way through the Site – UPRR,
- Closure of A-4 Gypsum Pond – Stauffer Chemical, and
- Page Pond remediation – Hecla, Sunshine Mining, and ASARCO.

EPA and the State of Idaho took on the responsibility of implementing the remaining remedial actions at the following site areas:

- Hillsides,
- Gulches (Grouse, Government, Magnet, and Deadwood),
- Smelterville Flats, north and south of Interstate 90,
- Central Impoundment Area,
- Industrial Complex (Lead Smelter, Zinc Plant, Phosphoric Acid Plant),
- Boulevard Area and Railroad Gulch,
- Mine Operations Area,
- Central Treatment Plant,
- Bunker Creek, and
- Milo Creek and Reed Landing.

Design and implementation of both PRP- and government-implemented remedial actions began in 1994. This 5-year review summarizes both PRP and government-lead activities.

A more detailed history of the Bunker Hill site is found in the Non-Populated Areas ROD.

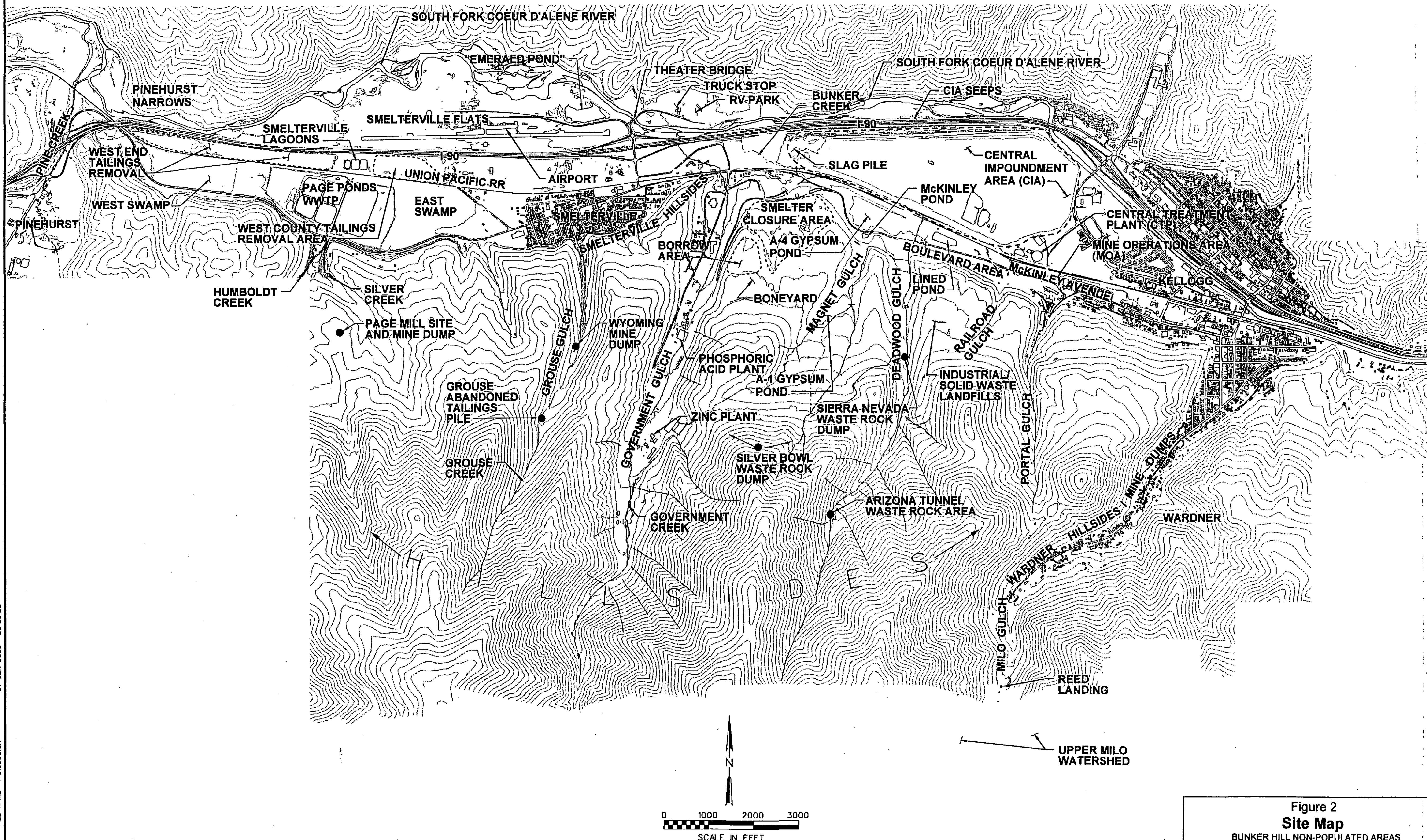

Figure 2
Site Map
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YR REVIEW

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3.3 Relationship of Site Activities with Coeur d'Alene Basin Investigation

The Coeur d'Alene River Basin (Basin) encompasses 1500 square miles of land in northern Idaho. The Basin, including Lake Coeur d'Alene, is the home of the Coeur d'Alene Indian Tribe (Tribe), and provides a variety of recreational uses. For over 100 years, the Basin has been the center of very intensive metals mining and smelting activities. In the center of the Coeur d'Alene River Basin sits the Bunker Hill Mining and Metallurgical Complex.

After the Bunker Hill site was placed on the NPL in 1983, EPA and the State focused their studies and cleanup on an approximate 3-mile by 7-mile area centered on the Bunker Hill Mining and Metallurgical Complex, the area of the most severe human health risk historically. This 21-square mile area included the surrounding communities of Kellogg, Wardner, Smelterville, and Pinehurst. The 1992 Bunker Hill Non-Populated Areas ROD specifically identifies remedial actions that are to be conducted within this designated 21-square mile area. Actions selected in the ROD do not address sources of contamination upgradient of the Bunker Hill Superfund Site, and while actions are expected to have benefits to downgradient SFCDR water quality conditions over time, active remediation of the SFCDR is beyond the scope of actions specified in the ROD.

In 1992, EPA, the State of Idaho and the Tribe entered into a Memorandum of Agreement to establish the Coeur d'Alene Basin Restoration Project, an attempt to investigate a broad range of environmental issues including agriculture, forestry, mining and urbanization. In 1996, EPA joined the federal natural resource trustees and the Tribe in a lawsuit against various mining companies in the Basin seeking judgement of liability for cost recovery and natural resource damages. The scope of the natural resource damage claim includes injuries to natural resources within the 21 square mile area as well as the broader Basin. Over the past several years EPA has been looking more closely at Basin-wide contamination issues.

In 1998, EPA initiated a RI/FS for the Coeur d'Alene Basin. The Bunker Hill Mining and Metallurgical Complex is located within the boundaries of the Coeur d'Alene Basin currently being investigated in the RI/FS.

The remediations conducted within the Bunker Hill 21-square mile site are being reviewed and considered by the Coeur d'Alene Basin investigation team within the context of the Basin's overall specific remedial objectives and will be coordinated with the Basin-specific RI/FS documents.

3.4 Source and Nature of Contamination

Contamination by heavy metals at the Site occurs in soils, surface and ground water, and air. Sources of contamination included jig tailings, flotation tailings, inflow of contaminants from upstream sources, air emissions from ore processing facilities, particulate dispersion from ore stockpiles, and residuals from the Industrial Complex. Additional sources include gypsum generated from phosphoric acid production and zinc fuming, and acidic, metals-laden mine water emanating from the Bunker Hill Mine.

Jig and flotation tailings were generated as waste products during concentration of mined ores. Jig tailings were generated by earlier mine concentrating techniques and were typically dumped on the valley floor. During flood events, these tailings were transported by the SFCDR, mixed with alluvium, and deposited on the flood plain. Over time, the valley floor throughout the site became mantled with a mixture of jig tailings, flotation tailings, and alluvium as floods occurred and as the SFCDR naturally meandered across the valley floor.

Flotation tailings, which were generated by an improvement to ore concentration methods that came into predominant use in 1930, were typically discharged to the CIA. The flotation tailings were identified during the RI/FS as an important source of air-borne contamination as well as a source of contamination to ground and surface waters.

Air emissions occurred from ore processing facilities. Although both the Lead Smelter and Zinc Plant had recycling processes designed to minimize air-borne particulates, significant metals deposition still occurred together with deposition of sulfur dioxide emissions. These affected areas near the Smelter and Zinc Plant as well as the surrounding hillsides.

Materials and residues from the Smelter Complex included ores, concentrates, sinter and calcine, copper dross flue dust, lead residues, slag, gypsum, and other materials and wastes. These materials were stored, transported, and occasionally spilled in various areas around the Site. Gypsum was generated during production of phosphoric acid, and slag was produced by fuming processes aimed at converting zinc to zinc oxide. For the most part, these materials were either concentrated in ponds or deposited in the CIA. Acid mine drainage was actively pumped to the east cell of the CIA until early 1991.

3.5 State Superfund Contract and Two Phase Site Implementation Strategy

Per CERCLA requirements for Superfund remediations led by the Federal government, and as noted above in Section 3.3, EPA and the State of Idaho entered into a cost-sharing agreement specific to the Non-Populated Areas Bunker Hill site as documented in the State Superfund Contract (SCC) (IDEQ and EPA, May 1995). In addition to defining the cost-sharing agreements, the SSC had several documents appended to it that provided a framework for decision-making and conducting the site cleanup. These appended documents included:

- Support Agency Cooperative Agreement: Documents agreements between EPA and the State concerning credits to the State for "in-kind" services and identifies those activities the State will perform to satisfy their financial obligations per CERCLA.
- Comprehensive Cleanup Plan: Outlines the conceptual approach to implement the remedy at the Site.
- Cost Memo: Summarizes the 1995 cleanup cost estimate that was developed by EPA and the State based on the implementation approaches summarized in the Comprehensive Cleanup Plan.
- Remedial Action Master Plan: Outlines the process by which an individual remedial action can be selected, refined, designed and constructed.

- Memorandum of Agreement: Defines the working relationship between the State of Idaho and EPA for the Bunker Hill Site cleanup.

The Comprehensive Cleanup Plan defines a two-phase implementation strategy for remediation of the Bunker Hill Superfund site. These two phases essentially define initial actions followed by reevaluation to confirm that the initial actions meet performance goals. Phase I work includes source removal actions aimed at removing and consolidating extensive contamination from various site areas, demolition of structures, development and implementation of an Institutional Controls Program (ICP), future land use development, and public health response actions. Phase I work also includes support studies for long-term water quality improvement. Phase I was expected to last approximately 8 years (1995 through 2002).

Phase II will be implemented following completion of source control and removal activities and evaluation of the effectiveness of these activities in meeting water quality improvement objectives. This phase will consider any shortcomings encountered in implementing Phase I and will specifically address long-term water quality, ecological, and environmental management issues.

4.0 Review of Selected Remedies

4.1 Site-Wide Considerations

This section summarizes issues and considerations that apply to the entire Site as opposed to particular remedial actions.

4.1.1 Bunker Hill Superfund Site 5-Year Review for Populated Areas

As discussed earlier in this document, the RI/FS for the Bunker Hill Superfund site was completed as two separate units, the populated (residential) areas and the Non-Populated Areas (river flood plain, hillsides and industrial complex). As noted previously, the ROD for residential soils in the populated area was completed in 1991, and the ROD for the remainder of the Site was filed in 1992. Since these operable units have been managed as separate efforts throughout the study and cleanup process, separate 5-year reviews are being conducted for the Populated and Non-Populated Areas. The completion of the 5-year review for the populated area is following a similar schedule as the 5-year review for the Non-Populated Areas. Most of the information in this section is based on the *Draft 1999 Five-Year Review Report* (TerraGraphics, March 2000) for the Populated Areas of the Site.

The approach for the 5-year review of the Populated Areas is different from that used for the Non-Populated Areas, as it focuses on the Site-Wide Remedial Action Objectives (RAOs) for lead adsorption defined in the two RODs. These RAOs are intended to reduce the incidence of lead poisoning in the community to:

- Less than 5 percent of children with blood lead levels of 10 micrograms per deciliter (µg/dL) or greater, and
- Blood lead level of no individual child exceeding 15 µg/dL (nominally 0.1 percent of population).

As stated in the *Draft 1999 Five-Year Review Report* for the Populated Areas, the two RAOs identified above are to be achieved by a strategy that includes:

- Remediation of all residential yards, commercial properties, and rights-of-way (ROWs) that have lead concentrations greater than 1,000 milligrams per kilogram (mg/kg);
- Achieving a geometric mean yard soil lead concentration of less than 350 mg/kg for each community in the Site;
- Controlling fugitive dust and stabilizing and covering contaminated soils throughout the Site; and
- Achieving geometric mean interior house dust lead levels for each community of 500 mg/kg or less, with no individual house dust level exceeding 1,000 mg/kg.

Remediation activities for the Populated Areas have focused on the residential yard soils, commercial properties and ROW. Early efforts to remediate interior of homes prior to yard remediation were delayed, since homes that were remediated without prior yard remediation were re-contaminated within one year.

The analyses included in the 5-year review technical report will summarize and assess progress of the following activities for the Populated Areas:

- Child blood lead levels,
- Barrier effectiveness,
- House dust lead levels,
- Institutional Controls Program,
- Fugitive dust,
- Other potential sources of exposure or recontamination,
- ARARs,
- Disposal, and
- Infrastructure.

Some of the above items are also addressed by the 5-year review for the Non-Populated Areas such as the barrier effectiveness, ICP, and ARARs. There have been efforts made to coordinate the work on both 5-year reviews.

Coordination between the two 5-year reviews will focus on how activities associated with either the Non-Populated or the Populated Areas may impact the effectiveness of the remedy or public health. For example, possible erosion of the hillsides above the towns of Wardner and Smelterville (included in the Non-Populated Areas) could cause contamination of residential properties included in the Populated Areas. In this case, the effectiveness of a remedy for the non-populated area may impact the remedy of an area within the populated area. The analyses that have been performed for the 5-year review technical report may also be useful for the non-populated area review. The 5-year review for the populated area includes some initial analyses of the effectiveness and durability of barriers that have been installed at the Site over the last 12 years. As many of the RAs conducted for the Non-Populated Areas include installation of barriers or caps, elements of this analysis may be used in evaluating the effectiveness of the remedy.

4.1.2 Application of the Institutional Control Program

Institutional controls as discussed in the Non-Populated Areas ROD are intended to assure the protectiveness of the remedial actions in Non-Populated Areas in which surface soil concentrations exceed residential soil cleanup goals for lead on properties that are likely to be developed in the future. For such areas, controls include access control (i.e., fencing, signs) and capping. Actions conducted by EPA and the State of Idaho in the Non-Populated Areas of the Site are not required to obtain ICP permits (such as those required in the Populated Areas of the Site), however, the technical requirements specified by the ICP must be met. Areas within the Site that are likely to be developed in the future are located primarily in the gulches, south of I-90 on Smelterville Flats, along McKinley Avenue, and within the hillsides.

The ROD requires an ICP be developed and identifies four main components of the ICP:

1. An environmental health code,

2. Performance standards for remedial actions (e.g. specifications for barriers),

3. An educational program for residents and contractors to familiarize themselves with ICP requirements, and

4. A testing and monitoring program to evaluate the effectiveness of the ICP.

The Panhandle Health District (PHD) formally approved their involvement as the management entity for the ICP in 1992 and proceeded to draft an Environmental Health Code, known as the Contamination Management Regulations. These rules were adopted under IDAPA 41.01 in February 1995.

The ICP includes management of a public disposal site for soil and other contaminated material disposal, inspection of homeowner- and contractor-performed projects, and education on the applicable elements of the ICP, health and safety awareness information, contractor licensing and training, sampling assistance, and project tracking of construction activities for particular properties to facilitate land transfers.

Performance standards for barriers were written into the Contaminant Management Regulations. Barrier types vary depending upon the site use activities.

Educational program elements include:

- Contractor licensing classes that are held twice each week;
- Printing and distribution of educational flyers on the various aspects of the ICP;
- Outreach, in the form of permit requirements, for projects exceeding 1 cubic yard of soil;
- A full-time inspector who is available for permit issuance, contractor licensing, health and safety awareness, community education, and sample assistance to identify areas of concern.

These actions include capping, enforcing existing controls on access, and maintaining existing fencing. These activities are intended to preclude migration of and human exposure to contaminants (Panhandle Health District, 1996).

Portions of the Site will be transferred to the State of Idaho once remedial actions are completed and performance standards have been achieved. ROD specified barriers (caps) are required for most areas where surface soil concentrations exceed residential soil cleanup goals for lead and which are likely to be developed. To facilitate the transfer of land and O&M responsibility, the ROD caps have been installed to meet the ICP performance standards. Once properties have been certified and transferred to the State, all of the elements of the ICP will apply to any entity intending to develop or otherwise use those properties.

A more thorough discussion of the ICP can be found in the Bunker Hill Populated Areas Operable Unit First Five Year Review Report. In addition, both UMG (MFG, 1999) and the State (TerraGraphics, 1999) conducted evaluations of the ICP, implemented by the Panhandle Health District under local statute as described above.

4.1.3 Health and Safety Review

Construction work funded by EPA and the State of Idaho at the Bunker Hill Superfund site was performed under the U.S. Army Corps of Engineers' (USACE) Safety and Health Requirements Manual EM 385-1-1 (September 1996). In addition, each of the USACE's remediation contractors working at the Site prepared their own project-specific health and safety (H&S) plan that met the requirements of the USACE's site-wide plan. H&S plans prepared by remediation contractors were then approved by the USACE. Within any given area of the Site, both the USACE's H&S plan and the remediation contractor's project-specific H&S plan would be in effect for all personnel in that area. Contractors were responsible for H&S for their own project, including subcontractors, although the USACE monitored and enforced operations for H&S compliance over the entire Site (Fink, 2000).

Accordingly, the prime contractor at the Site operated under their own USACE-approved project-specific H&S plan that was consistent with requirements of the Occupational Safety and Health Administration's Hazardous Waste Site Regulations (CFR 1910.129 and 29 CFR 1926.65). The H&S plan covered the following information (MK, 1999):

- Hazard evaluation of the Site and work performed at the Site,
- Training requirements for any and all personnel,
- Actions required for medical surveillance of workers,
- Required personal protective equipment,
- Health and safety monitoring, including air, noise, heat stress, confined space, perimeter, and mercury vapor monitoring;
- Personnel sampling for lead exposure, asbestos, total and respirable dust, cadmium, and arsenic;
- Health and safety work precautions and procedures;
- Site control measures such as establishment of work zones: support, contamination reduction and exclusion zones, and related procedures;
- Personnel and equipment decontamination and hygiene procedures;
- Onsite first aid;
- Emergency response plan; and
- Record keeping requirements.

Subcontractors operated under a prime contractor's H&S plan or, in the case of specialty work, prepared a site- and activity-specific H&S plan which was reviewed and approved by both the prime contractor and the USACE.

Success of the H&S procedures and safety emphasis at the Site can be judged by the fact that after five plus years, involving over 1,000,000 person-hours on the project with a work force of over 200 personnel and 175 pieces of heavy equipment, no lost time accidents or injuries occurred.

4.1.4 Operation and Maintenance Plans

In January 1999, the IDEQ and EPA began planning for the transfer of O&M responsibilities from the federal government to the State of Idaho for those portions of the Bunker Hill site that were cleaned up under the government-implemented program. The PRPs are responsible for preparing O&M plans and conducting long-term O&M for the remaining remedial actions at the Site that they are responsible for.

For the government-implemented remedial actions, the State of Idaho is taking the lead to develop the O&M program for these portions of the Bunker Hill site. A report of the progress that has been made to date on the State's O&M program was presented in the *State Lead Activity Update/Summary, Operation and Maintenance Project Bunker Hill Superfund Site Memorandum*, (TerraGraphics, December 23, 1999). The development of the program has included the participation of the local community including officials of Kellogg, Smelterville, Pinehurst, Wardner, and Shoshone County. The goal of the State is to efficiently transition remediated properties into productive use in accordance with land use requirements while maintaining the integrity of the remedy.

The main features of the State's O&M program are described below.

4.1.4.1 Framework and Format Feasibility Study

As the State plans for taking on the O&M of the Site, it is investigating alternative means by which O&M services can be delivered. Based on the current preliminary analysis of alternatives, the most viable option is a phased approach, initially using an existing entity, i.e., IDEQ or the PHD, followed by creation and implementation of a new, long-term means such as Charter Unit of Local Government or Legislative Action. Evaluations are ongoing to further refine the manner in which the long-term O&M for the Site will be delivered.

4.1.4.2 Operation and Maintenance Manuals

Separate O&M manuals will be prepared for each remedial action. The O&M manuals are being completed as a joint effort by IDEQ and EPA. Smelterville Flats has been selected as the O&M Manual to be used as a model for developing the other plans and is anticipated to be complete in 2000.

4.1.4.3 O&M Site-Wide Plan

All elements of the O&M program for the Bunker Hill site will eventually be presented in the O&M Site-Wide Plan. The main elements of this plan include:

- **Management Framework and Format:** The selected means for delivering O&M for the Site and how the O&M program will be administered will be presented.
- **Property Management**: Land use issues will be addressed, and the procedures for property transfer.
- **Site Inspection and O&M Requirements**: These will be presented for each remedial action.

4.1.5 Activities Undertaken for the 5-Year Review

Several sources of information and data were used to conduct this initial 5-year review for the Bunker Hill site, including decision documents (i.e., the 1992 ROD, ROD amendment, and ESDs); area-specific remedial design (RD) reports; construction plans and specifications; site monitoring reports; remediation completion reports; and interviews with site personnel involved in the specific remediations.

The references used for each remedial action review are summarized in Section 8 and listed according to each particular remedial action. This list of references includes all documents reviewed to evaluate each remedial action. Those references that are specifically cited within the text of this report are shown to emphasize specific facts or data. Other references in Section 8 that are not specifically cited within the text of the report are included as background documentation.

4.2 Site-Wide Monitoring

The ROD requires periodic monitoring of soil, water and air at the Bunker Hill Superfund site to provide information about the changing nature and extent of contamination of various media. ROD-stated objectives of Non-Populated Area monitoring are:

- To evaluate compliance with ARARs in surface water and groundwater,
- To assess the status of environmental receptors (i.e., biological monitoring),
- To evaluate the performance of specific remedial actions and their respective O&M programs,
- To evaluate the adequacy of control measures instituted during the implementation of remedial actions, and
- To evaluate the success of remedial actions in protecting human health and the environment and determine the adequacy of remedial actions selected in the ROD.

Monitoring is also used in conjunction with design to meet the objectives of the ROD. Surface water, groundwater, and air monitoring at the Bunker Hill Superfund Site is being performed by EPA and the State in three different programs:

- The Site-Wide Surface Water, Groundwater and Air Monitoring Program
- The Hillsides Monitoring Program
- The Smelter Observational Approach Monitoring Program

These programs are described in general below. Biological monitoring of wildlife is currently being planned under an inter-agency agreement between EPA and the U.S. Fish and Wildlife Service. This monitoring is expected to begin in 2000. A description of the biological monitoring program and any results obtained from this program will be addressed in a future 5-year review report.

4.2.1 Surface Water, Groundwater, and Air Monitoring

4.2.1.1 Background

From 1987 to 1993, surface water, groundwater, and air monitoring at the Bunker Hill Superfund site was conducted by consultants to the PRPs. PRP sampling events were carried out by Dames & Moore in 1987, 1988, and 1991 in support of the Site's RI/FS. PRP monitoring programs conducted in 1992 and 1993 by McCulley, Frick and Gilman were part of site-wide monitoring requirements of an AOC from EPA (U.S. EPA, 1990). The bankruptcy of the primary PRP in 1994 resulted in EPA conducting the necessary site-wide monitoring.

The air-monitoring program was restarted in 1995 by the Corps of Engineers to monitor fugitive dust that could potentially be generated by the ongoing government cleanup efforts. EPA and the State of Idaho provided oversight of the air-monitoring program. EPA conducted the quarterly and monthly surface water and groundwater sampling programs for one year beginning in October 1996. After that year, the State of Idaho took over the groundwater and surface water site-wide monitoring responsibility and has continued from October 1997 to the present.

4.2.1.2 Objectives

The site-wide surface water, groundwater, and air monitoring program is intended to record and report on the changing nature and extent of contamination in the Non-Populated Areas as remedial actions are implemented.

The objectives for the site-wide groundwater and surface water monitoring are to:

- Provide documentation on the condition of groundwater and surface water media site-wide,
- Support remedial design, and
- Monitor the effectiveness of remedial actions.

When the program was re-started in 1996, existing monitoring wells and surface water sites were used when at all possible. The groundwater wells were installed during several different investigations over the past 10 years. During the last several years of remediation work at the site, several wells have been destroyed or damaged such that monitoring in these wells was no longer possible. The existing site-wide monitoring program will continue to be evaluated, expanded and modified as necessary to obtain the data necessary to evaluate performance of the remedies.

Figure 3 shows the locations of groundwater wells and surface water monitoring sites as of January 1999. Groundwater and surface water samples are sampled on a quarterly basis.

A total of 61 wells are typically sampled during the quarterly monitoring programs. The areas monitored and the number of wells in the vicinity of each area are:

- CIA, Slag Pile, and CIA seeps– 19 wells
- Smelterville Flats (north of I-90) – 8 wells
- South of I-90 – 7 wells

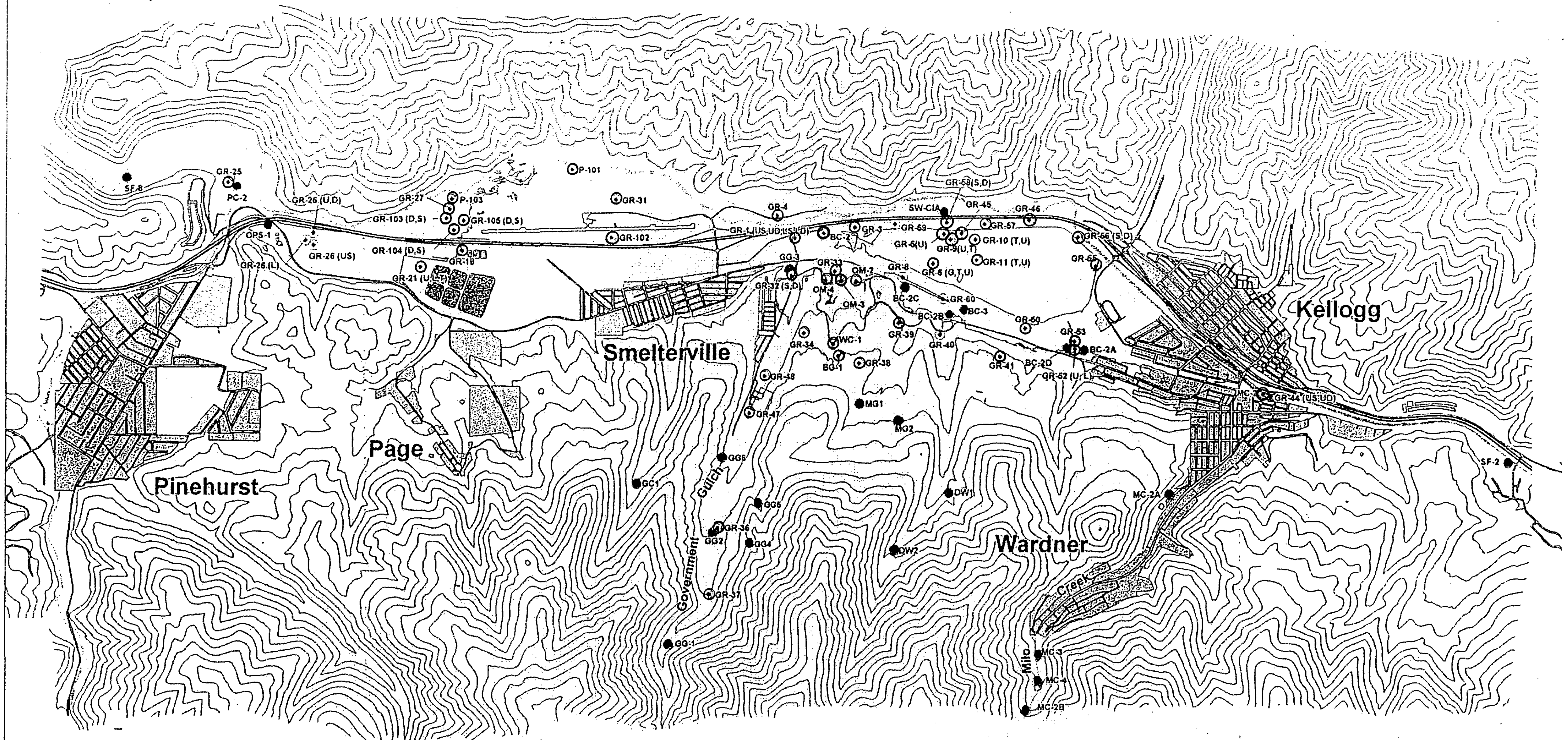
- Lead Smelter – 8 wells
- Government Gulch – 6 wells
- City of Kellogg – 2 wells
- Industrial Landfill – 1 well
- Deadwood Gulch – 1 well
- Magnet Gulch – 1 well
- Bunker Creek – 6 wells
- Lined Pond – 1 well
- North of Pinehurst – 1 well

The groundwater samples obtained from these wells are analyzed for dissolved arsenic, antimony, cadmium, lead, mercury, zinc, and copper. Field parameters include temperature, pH, conductivity, and groundwater level where possible.

The surface water-monitoring program is being developed to focus on metals concentrations at Smelterville Flats and within the tributaries to the SFCDR upstream and downstream of remediation areas, specifically:

- Smelterville Flats – 2 sites
- Milo Gulch – 5 sites
- Magnet Gulch – 2 sites
- Deadwood Gulch – 2 sites
- Pine Creek – 1 site
- Bunker Creek – 6 sites
- Government Gulch – 6 sites
- Page Pond – program being developed by PRPs)

The 24 surface water sites are monitored for total and dissolved arsenic, mercury, lead, zinc, copper and antimony and total suspended solids (TSS).



Legend

Groundwater Monitoring Wells

Surface Water Monitoring Locations

DRAFT MAP

THE GEOGRAPHICAL CONTROL FOR THIS MAP IS IN QUESTION AND THEREFORE IT IS NOT INTENDED AS AN ILLUSTRATION OF LEGAL BOUNDARIES OR LOCATIONS

0 0.5 1.0 miles

Scale 1 : 31,680

N W E S

File	1999-01-15 SWMON / gwm.wor	Requestor	S. Koerber, W. Melton
Date	15JAN99	Designer	B. Bailey
Project No.	3208	Cartographer	B. Bailey
		Approved	

TerraGraphics Environmental Engineering, Inc.

Site Wide Monitoring

Ground and Surface Water Monitoring Locations

Figure 3
Groundwater and Surface Water Monitoring Locations

BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

22-APR-2000 10:50:13

In 1995, air monitoring was reestablished for the purpose of monitoring air quality during site remediation activities. The monitoring locations varied depending on where remedial activities were occurring.

4.2.1.3 Results To-Date

A. Groundwater and Surface Water

In February 1998, EPA compiled a partial set of the results of the groundwater and surface water sampling that had been performed to date (CH2M HILL, 1998). In 1999, IDEQ analyzed the results of the sampling that had been performed to date for trends (TerraGraphics, 1999).

Presently, the State's trend analysis report exists in draft form only. This document analyzed results from historic samples as well as data from the current surface and groundwater-monitoring program through 1998. The trend analysis report will be updated to include monitoring data collected in 1999. The memorandum concluded that:

- There were not enough observations to determine trends over time. A minimum of 15 to 25 observations collected, preferably at uniformly spaced sampling events, are required for statistically valid conclusions of trending.
- A strong correlation between the presence and concentration of cadmium and zinc was found across most areas of the Site. Discrepancies exist however, which indicate extremely variable materials.
- Samples with arsenic readings exceeding the 50 µg/L Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) were found in only 6 wells on the CIA.
- Cadmium consistently exceeded 5 µg/L (SDWA MCL) in wells throughout the Site (29 of 34 wells) but only in 2 of 6 surface water sites.
- Lead exceeded 15 µg/L (SDWA MCL) in 15 of the 34 wells, but only in 1 of the 6 surface water samples.
- Zinc levels varied widely throughout the Site. Three of the four wells with zinc levels greater than 100,000 µg/L were in Government Gulch. Smelterville Flats samples were generally lower than the rest of the Site with none exceeding 50,000 µg/L. The results of samples taken from Central Impoundment Area (CIA) wells generally fell mid-range.

The fact that significant trends were not identified in the analysis was to a degree anticipated since at the time of the last sampling event a great deal of work on the remedial actions around the Site was being performed, and few of the remedial actions and none of the remedies for an entire sub-area were completed.

Existing monitoring data is most useful to document the condition and variability of pre-remedial and implementation stages of the remediations. As work progresses and is complete at the Site, future 5-year review reports will continue to include a discussion of surface water, groundwater, and air monitoring results to assess remedy performance over time.

The primary conclusion concerning the status of the site-wide monitoring program is the need to re-evaluate the program to determine if sufficient and appropriately located data is being obtained to assess whether performance standards are being achieved and whether the installed remedy is protective of human health and the environment. EPA and the State of Idaho plan to conduct this re-evaluation of the site-wide monitoring program beginning in the fall of 2000.

B. Air Monitoring Program

As noted above, the purpose of the air-monitoring program was to monitor fugitive dust that may be generated during the various site cleanups. For the safety of the general public, the applicable levels for comparison to measured data are the National Ambient Air Quality Standards (NAAQS) for particulate matter less than 10 microns (PM10). Air monitors were installed around ongoing government cleanup efforts implemented by the U.S. Army Corps of Engineers (USACE) and overseen by EPA and DEQ. Table 4-1 is a summary of total suspended particulate (TSP) ambient air quality results for the years 1995 through 1998 (CH2M Hill, 2000)[1] and a breakdown by season.

Table 4-1
TSP Ambient Air Quality Monitoring Results – Aggregate Results

Total number of days monitored	814
Total number of 24-hour concentrations that exceed NAAQS – 0.150 mg/m3 in the period from June 1995 to January 1999	47
Number of 24-hour exceedances by season	Spring – 10 Summer – 18 Autumn – 11 Winter - 8

Table 4-2 presents TSP exceedances for each site by year. It should be noted that data exceedances do not necessarily indicate the presence of contaminants (i.e., the dust could be "clean" dust).

[1] Suspended particulate matter measured at 10 microns or less (PM10) is a subset of total suspended particulate (TSP).

Table 4-2
TSP Ambient Air Quality Exceedances- Individual Sites by Year

Site / Year	1995	1996	1997	1998	Total Exceedances /Total Measurements/Percentage
Bunker Avenue	0	0	0	6	6 out of 49 / 12%
East Gate	0	3	2	2	7 out of 173 / 4%
East Gate - Collocated	0	2	4	1	7 out of 174 / 4%
Multi-plate	0	0	2	9	11 out of 54 / 22%
Pinehurst	0	0	3	1	4 out of 46 / 9%
Smelterville Gate	0	2	4	0	6 out of 135 / 4%
West Gate	0	0	3	2	5 out of 182 / 3%
Total Exceedances	0	7	18	21	46 out of 817 / 6%

The data in Table 4-2 indicates that a number of exceedances are associated with heavy haul-route areas such as the "multi-plate" (overpass) structure built in Smelterville to convey tailings parallel with Interstate 90 from the Smelterville Flats to the CIA. This portion of the haul route has been removed and no longer needed[2], therefore, no further action is warranted with respect to these exceedances. All of the site areas in Table 4-2 were used by construction equipment and these areas were frequently watered to control dust. Some areas (such as the CIA and haul road) were sprayed with dust suppressants including lignin and magnesium chloride on a periodic basis. The air monitoring data indicates a need to continue and perhaps increase dust suppression near active work areas, such as the ongoing CIA work that began in 1999 and is scheduled to be completed in 2000. This monitoring will occur as part of the CIA Closure contract and will be evaluated as part of the contractor's performance. No new sources of fugitive dust have been identified since the RI/FS.

4.2.2 Hillsides Monitoring Program

4.2.2.1 Background/Objectives

In 1999, a Hillsides Monitoring Program was begun to measure plant growth, sediment discharge, surface water quality, and other parameters in particular drainages impacted by the re-vegetation and erosion control work on the hillsides (White, 2000a). This monitoring program was designed during a series of workshops attended by EPA, IDEQ, USACE, U.S. Bureau of Land Management (USBLM), Washington State University (WSU), TerraGraphics and CH2M HILL that identified goals, objectives and performance standards for the Hillsides work, summarized in greater detail in Appendix A (CH2M HILL, 1999). This program is intended to:

[2] This route was constructed with clean fill material, and trucks entering the haul route were decontaminated before traveling the route.

- Measure achievement of project goals and objectives,
- Validate the interim performance standards, and
- Evaluate the effectiveness of the hillsides' design elements.

Evaluation of hillside design elements will be achieved using performance monitoring of the particular remedial activities to ensure that they are performing as intended. Beyond this evaluation, on-going monitoring will help to determine whether the remedial action goals are being met and whether the remedies are protective.

A. Hillside Performance Monitoring Activities:

1. Aerial photography interpretation to estimate area percent cover (with ground-truthing) in all treated management areas. Use color infrared photographs shot during the annual June flight 2 years after the first construction season. (Infrared aerial photographs provide better definition of vegetation than standard color aerial photographs).

2. Aerial photography interpretation to estimate area percent cover in all major gullies and on check-dam terraces[3]. Use color orthographic photographs shot during annual June flights 2 years after the first construction season.

3. Use site inspection to look for evidence of regeneration from seed production, new shoot growth, and sprouting from damaged or cut stems at the end of the third growing season.

4. Perform site inspection to determine presence of noxious weeds listed in the State of Idaho Noxious Weed Regulations at the end of the second full growing season.

B. On-Going Hillside Performance Monitoring Activities:

1. Inspect each check dam after installation and at least once per year for proper impedance/retention of flow.

2. Continuously measure precipitation, air temperature and wind speed (White, 2000a) at a minimum of one weather station onsite. Continuously monitor turbidity and flow at up to 10 sample sites situated in sub-watersheds that would experience impact of check dams and plantings. Measure total suspended solids (TSS) periodically at each station via grab sample.

3. Use results of metals analyses of surface water samples taken quarterly from sites expected to be impacted by check-dams and plantings.

4. Convene project team at least annually to review the results of the monitoring program and recommend acceptance or modification of the program for the future.

4.2.2.2 Hillsides Monitoring Results To-Date

The monitoring program is not yet fully in place and the hillsides' remedy is not projected to be fully installed until 2001. A pilot surface water-sampling program is currently being

[3] Hay or straw bale "dams" staked into the ground on hillside terraces for the purpose of retarding or retaining surface water runoff in order to minimize erosion and maximize water seepage into the hillside soils as much as possible.

established and data loggers installed. A weather station is in place. Check dams will be inspected once they are all constructed. Initial data for all of these elements are expected by late 2000. The entire monitoring program is expected to be operational at the time the hillsides re-vegetation solution is completed in late 2001 (White, 2000b).

Data collected by the performance-monitoring program will be compiled by CH2M HILL. These data will be presented in an annual monitoring results report.

Results of the performance-monitoring program will be reviewed by the project team every 2 years to guide the program in providing the information needed to ensure that the needs of the hillsides' watersheds are being met.

Because the remedies are in the process of being implemented, monitoring data collected from some stations may be considered as background data. Lack of background data from some of the monitoring sites needs to be considered while evaluating data generated from the program. Future 5-year review reports will include a discussion of hillsides monitoring results in order to evaluate the performance of the hillsides remedy over time.

4.2.3 Smelter Closure Observational Approach Monitoring

4.2.3.1 Background

At the time the ROD was written, the Lead Smelter area was one of the most contaminated areas of the Industrial Complex at the Bunker Hill Superfund site. The ROD required that the Lead Smelter be demolished and contaminated materials consolidated and capped within that area to limit direct contact with contaminants and control migration of contaminants to surface and groundwater (EPA, 1992). With respect to seepage collection from the capped Smelter Closure area (see Figure 2), the ROD also directs that other appropriate Resource Conservation and Recovery Act (RCRA) requirements for closure of existing facilities will be incorporated into the closure design (EPA, 1992).

During the predesign phase of the Smelter Closure area, a cost-benefit analysis was conducted to evaluate the effectiveness of a groundwater seepage collection system down-gradient from the Smelter Closure. A groundwater interceptor trench was found to be infeasible due to the high construction cost, combined with the presence of an extensive low permeability-confining layer between the consolidated waste and the perched groundwater table underlying the closure area. Based on this cost-benefit analysis, an observational method was implemented to monitor groundwater quality at the down-gradient edge of the closure over time (CH2M HILL, 1996a).

To address a minor amount of seepage that historically flowed along the ground surface of the Smelter Closure area and into structure basements, a seepage toe-drain (approximately 4 feet deep) was constructed along about 800 lineal feet of the 1,100-lineal-foot long northern edge of the closure. The seepage collected from this toe-drain is hard-piped to the Sweeney Pump Station located near McKinley Avenue north of the closure. This water is then conveyed to the Lined Pond and the CTP for treatment.

The observational method for the Smelter Closure involves evaluating groundwater quality down-gradient of the closure area by monitoring a network of groundwater wells in the vicinity of the closure. When monitoring was started in 1996, 10 wells made up the network of wells monitored. During the construction of the Smelter Closure, 2 wells were damaged and not replaced, therefore, the current network consists of 8 wells (2 up-gradient and 6 down-gradient). Six of the eight wells are being sampled monthly and two of the eight wells are being sampled quarterly as part of the site-wide monitoring program for water level, and dissolved and total lead, zinc, cadmium and arsenic concentrations (CH2M HILL, 1996b). Monitoring began in February 1997 and continues to the present.

The Smelter Closure cap was constructed over two seasons and was completed in 1998. Based on flow modeling and permeability rates anticipated in the various Smelter Closure elements, the seepage volume is expected to decrease rapidly in the first 3 years after final closure. Within 4 years of closure (December 2002) the seepage volume is expected to approach the steady-state value of less than 1 percent of the annual precipitation (CH2M HILL, 1996a). Based on these analyses and the presence of the low permeability confining soil layer underlying the closure, water quality, as measured at the down-gradient edge of the closure, is not expected to be adversely impacted by the contaminated materials consolidated in the closure. Should water quality measurements over time indicate that groundwater quality is worsening as a result of the consolidated contaminated materials in the Smelter Closure, the need for addition remedial actions will be evaluated.

4.2.3.2 Objectives of Smelter Closure Observational Approach Monitoring

This objectives of the Smelter Closure Observational Monitoring approach are to:

- Provide a cost-effective design approach based on the most probable site conditions.
- Establish a program to monitor reasonable deviations from probable conditions including identifying parameters to be observed and evaluating actual conditions.
- If necessary, select a course of action or remedial design modification based on the observational findings. For example, if groundwater quality measurements (taken up-gradient and down-gradient of the Smelter Closure area) indicate that water quality is actually worsening over time, an evaluation will be conducted to determine if the consolidated materials in the closure are the most likely source. If determined as the source, additional remedial actions will be evaluated for the closure, such as collection trenches and traditional treatment or in-situ treatment walls.

4.2.3.3 Results To-Date

Data is currently being collected and compiled. A draft memorandum describing the status of the seepage monitoring with data evaluation for the interim period before the Smelter area was capped was prepared in November 1998 (Turner, 2000). The next memorandum presenting analysis of data collected through the first year after the cap was completed will be prepared by December 2000. Future 5-year review reports will include a discussion of monitoring results in order to evaluate the performance of the Smelter Closure remedy over time.

4.3 Review of Specific Site Work and Remedial Actions

4.3.1 Hillsides Remedial Action

4.3.1.1 Background

The hillsides within the Bunker Hill site have been impacted by 100 years of mining and metals refining related activities. These activities include logging and clearing, mine waste rock dumping, and emissions and fugitive dust from processing operations. Natural events such as forest fires, wind and flooding have increased the impacts to the hillsides leading to severe erosion and reduced vegetation in many areas. The erosion of the contaminated soils from the hillsides has resulted in contaminants being conveyed to the streams, gulches and other areas.

In the ROD, the remedial action for the hillsides is based on the 1990 Pintlar AOC 1990 for Re-vegetation and Stabilization. The major requirements of the ROD are shown in Table 4-3. The remedial action is to focus on the approximately 3,200 acres of hillsides identified in the AOC work plan. These areas were selected as the areas that were severely eroded, having less than 50 percent vegetative cover. This is based on the Remedial Investigation (Dames and Moore, 1990) that evaluated about 12,000 acres of the hillsides. Severely eroded areas within the area that had more than 50 percent vegetative cover are also to be re-vegetated.

Clear project goals are fundamental to the development of design solutions for the hillsides. Project goals identify the desired end point for land management. The AOC (EPA, 1990) calls for areas having less than 50 percent cover to be re-vegetated, as well as for the implementation of a number of slope stabilization and erosion control measures. The ROD goes on to discuss an EPA-approved PRP workplan that seeks 85 percent ground cover within 8 to 12 years. It also emphasizes the establishment of 100-foot-wide riparian corridors. However, the ROD does not identify which stream systems are to receive this treatment, neither does it state that all streams must receive treatment. The ROD also expects re-vegetation efforts to occur in areas where there is a high potential for contaminant transport and to develop new access where it is environmentally acceptable.

The primary purposes of the individual hillside remedial actions are (EPA 1992):

- Contouring, terracing and re-vegetation are intended to control erosion and increase infiltration.
- Erosion control structures and surface water treatment activities are intended to reduce the suspended sediment/contaminant loading in surface runoff to the SFCDR.
- Surface armoring, or covering the mine waste rock dumps, is intended to control direct contact or erosion hazards.

4.3.1.2 ROD Requirements

ROD requirements for the hillsides are summarized in Table 4-3.

Table 4-3
Hillside Remedial Actions

ROD Requirements	Remedial Action Objective/Goal	Document
1. Contouring, terracing and re-vegetation of areas with <50% cover	Reduce erosion and increase infiltration	ROD 9.2.1
2. Spot re-vegetation of areas with >50% cover within areas that are >50% cover class and have high potential for contaminant transport	Control erosion and increase infiltration	ROD 9.2.1
3. Surface armor or soil cover on selected mine waste rock dumps	Control direct contact or erosion hazard	ROD 9.2.1
4. Enforce existing controls on access	Human contact	ROD 9.2.1
5. Maintain existing fencing	Human contact	ROD 9.2.1
6. Some or all of the solid waste landfill material may be relocated to the Lead Smelter Closure. Contour and re-vegetate disturbed areas.	To reduce surface infiltration through potential source materials; to reduce potential groundwater loadings from these sources	ROD 9.2.5/ ESD 12-95/ ESD 4-98
7. Surface water flows at the solid waste landfill will be returned to their natural conditions to the extent practicable.	Control erosion	ESD 12-95

The ROD also called for monitoring of the performance and maintenance of erosion control structures until re-vegetation efforts are proven successful.

A. Implementation of Hillsides Work

The 1990 Hillsides AOC resulted in the PRPs beginning remedial work on the hillsides prior to the ROD being finalized. The remedial work conducted by the PRPs is described in Section 4.3.1.3, Description of Remedial Actions Conducted at the Site. In general, the PRP-implemented work on the hillsides consisted of hillside terracing, installation of check dams to minimize further erosion in gullied areas, tree-planting programs, and erosion control measures at select mine waste dumps.

With the bankruptcy of the Site's primary PRP is 1994, EPA and the State took on the responsibility of the additional hillsides remedial work necessary to achieve the requirements of the 1992 ROD. The initial planning conducted by EPA and the State was to review and refine the performance standards as necessary to result in a cost-effective hillsides remedy. The process used to evaluate and document hillside performance standards is described below.

B. Agency Guidance Statement Workshops

While the ROD provides general guidance regarding hillside remedial actions, it did not define specific actions that could be used in actual projects. As a result, prior to implementation of remedial actions on the hillsides, a series of three workshops (January and April 1998, April 1999) were convened to refine the purpose, goals, objectives, and interim performance standards of hillsides remedial actions. The concept of the workshops was to provide consensus-based guidance for developing specific re-vegetation solutions within the spirit of the information provided by the ROD. A significant additional benefit of the workshops is that they resulted in a platform for both a Monitoring Plan and a short- and long-term Hillsides O&M Plan. At the time of this review, the Monitoring Plan has been prepared. Participants in the workshops included EPA, USACE, BLM, IDEQ, and their consultants including CH2M HILL, Dr. Ed DePuit (Washington State University), and TerraGraphics.

Upon examination of the ROD, two general themes emerge: hillsides projects should ultimately control erosion and sediment discharge and, as a secondary consideration, improve the ecological function of the watershed. These themes were captured in two goals during the workshop that ultimately are the drivers behind the hillsides design decisions (Appendix A). The first goal is to improve overall watershed function by reducing runoff, soil erosion, and pollutant transport. The project team is accomplishing this goal through re-vegetation, installation of check dams, and other approaches. The second goal is to ensure that the design approach provides a permanent solution to erosion and sedimentation control by using plant species capable of natural reseeding or other forms of regeneration, and in addition, also return supplemental societal or ecological value to the watershed. This goal is being addressed by use of soil-building species and use of native species believed to be capable of natural regeneration within the harsh hillsides environment.

In addition to providing more specific guidance than was used in the ROD, the workshops formalized the process of adaptive management of the hillsides. This management technique will result in periodic review of the hillside design solutions to ensure that the requirements of the ROD and the needs of the overall project goals are met. The guidance statements generated by these workshops are found in Appendix A and discussed in greater detail in the *Bunker Hill Hillsides Re-vegetation Conceptual Plan and Monitoring Plan* (CH2M HILL, 1999).

These guidance statements form the basis for long-term monitoring of hillside performance. As such, adaptive management will also allow for conversion of "interim" performance standards to final performance standards. It will do so through monitoring of the standards in the field for their success in meeting sediment discharge goals to the SFCDR.

While the output of the workshops has provided clear direction for work conducted on the hillsides, the guidance statements may require more formal confirmation through an ESD. As part of reviewing annual hillsides monitoring and trend reports, it is recommended that the need for either an ESD or ROD Amendment be also evaluated to address the adaptive management approach for establishing hillsides' performance standards.

4.3.1.3 Description of Remedial Actions Conducted at the Site

A. Erosion Control Structures

Terraces. Mining companies built bench terraces, over a period of several years, as a first step in a program of hillside stabilization. Pintlar Corporation installed

25.6 miles of terrace construction across 29 separate benches in 1992 (EPA, 1992). Pintlar Corporation designed these bench terraces to have zero longitudinal slope with an approximate 20 percent inslope (EPA, 1992). One bench was to be installed for every 100 feet of elevation change, with each bench averaging 14 to 16 feet in width (EPA, 1992). The highest terrace bench was constructed at an elevation of about 3,700 feet. Prior to 1992, an additional 43 miles of terrace were constructed. In total, approximately 69 miles of terraces have been constructed in the project area.

Terrace construction shortens slope length and reduces water velocity as it flows down the mountain. The terraces were designed to hold surface runoff from a 2-inch event, assuming no infiltration (Harbert, 1992). The construction of flat terraces helped reduce the direct discharge of runoff to the gulches, but also resulted in indirect, negative effects. Bench terrace construction inevitably produced cut-and-fill slopes that were steeper than the surrounding area. Subsurface mineral matter was exposed at the cut-and-fill slopes, and the cut-and-fill slopes extended for significant distances both upslope and downslope of the benches. These areas present some of the greatest re-vegetation challenges.

Check Dams. As a secondary physical blockage to runoff, straw bales were to be installed as check dams on the benches. Each check dam was to be keyed into the slope using approximately 3 to 15 bales per dam in one to three layers, depending on the specific installation. However, although terrace benches were installed, the Pintlar did not install check dams in many areas. This led to channeled flow, additional down-cutting of gullies, and in places, mass movement and sediment discharges to streams. Down-cutting is especially severe along the western slopes of Government Gulch and it results in significant discharge of sediment to Government Creek and, eventually, the SFCDR.

As a result of this initial marginal stabilization effort by the PRPs, EPA and the State began more extensive erosion control work in 1998 and 1999 after the government took over the Site. In 1998 approximately 500 straw bale check dams, three to six log pole toe-of-gully check dams, and 400 inner gully and toe-of-gully check dams were installed along the hillside terrace benches. Additional work on check dam installation was completed in 1999 including use of concrete "ecology blocks" at the base of large gullies. These latter check dams are designed to withstand the larger flow events occurring in the gullies. As a result, check dam installation work actually extended the original plan of the PRPs by installing not only straw bale check dams, but also larger dams within larger gullies. Check dam installations occurred in Deadwood, Grouse, and Government Gulches.

The performance of each check dam will be evaluated regularly beginning in the summer of 2000.

Additional check dam structures were installed in the gulches and are evaluated in the Section titled "Gulches".

B. Re-vegetation Programs

PRP-Implemented Re-Vegetation Programs. The Remedial Investigation (Dames & Moore, 1990) identified 1,424 acres with from 0 to 25 percent vegetative cover;

1,697 acres with from 25-50 percent cover; and 8,873 acres with between 50 and 85 percent cover. Areas with less than 50 percent cover (3,121 acres) of the 11,994 acres studied or about 26 percent were targeted for re-vegetation. Much of this acreage was planted by the PRPs with small tree seedlings prior to the bankruptcy of the Site's primary PRP.

Between 1975 and 1982, the Bunker Hill Company planted approximately 2 million tree seedlings over 2,290 acres of the Site. In 1990, under direction of the AOC, Pintlar initiated a seedling planting program that extended from 1991 until 1994 when Gulf (their parent company) declared bankruptcy. From May through June 1991, Pintlar planted 140,000 tree seedlings on just under 300 acres and hydroseeded a total of 45 acres. Pintlar also performed soil sampling and analysis for 1991 planting areas, surface water sampling and meteorological monitoring.

In 1992 and 1993 additional tree planting was performed by Pintlar. Approximately 1,287 acres were scheduled to be planted in these 2 years, however because this effort was not fully documented, it is uncertain how many acres or trees were actually planted. And in 1994, Pintlar planted 100-400 trees per acre on 758 acres and 400-450 trees per acre on 215 acres.

EPA and State-Implemented Re-vegetation Programs. During the last 5 years, re-vegetation by the government-lead project has primarily focused on re-vegetation of the most highly denuded portion of the hillsides. This area, measuring 1,050 acres in size, is an almost contiguous block of land located primarily within Government, Deadwood, Magnet, and Grouse Gulches (Figure 2). This area is known as the Hillsides Project Area. It consists of steep, terraced hillsides with acidic soils.

In 1996, EPA and the State planted 200,000 white pine seedlings in areas that had not been planted by the PRPs.

In 1997, EPA and the State conducted an evaluation of the success of the planting efforts conducted to date. Many of the trees planted by the PRPs and others were found to have generated only a minimal amount of aboveground growth, particularly within the hillsides project area. The acidic conditions, lack of nutrients and water, rockiness of the soil, and steepness of the hillside slopes combine to make growing conditions very difficult at the Site. As a result, much of the projected cover and erosion protection from the trees has not been realized. In response to the difficult growing conditions, the major re-vegetation activities since that time have focused on establishment of grasses and forbs (herb-like plants) that, while protective of the hill slopes, would not significantly compete with the trees in the long-term.

To optimize re-vegetation approaches, demonstration test plots were installed in 1997 on some of the steepest and rockiest portions of the hillsides. The primary purpose of the re-vegetation test plots was to evaluate the effectiveness of various soil amendments, seed mixes, and hardiness of different plant species. The demonstration plots were the initial step in the adaptive management approach to the hillsides remedy, were evaluated after one growing season, and provided the necessary data to optimize the initial larger-scale re-vegetation program conducted in the spring of 1998.

Information regarding EPA and the State's approaches and considerations regarding hillside re-vegetation are presented in the *Hillsides Re-vegetation Conceptual Plan and Monitoring Plan* (CH2M HILL, 1999). The plan presents a range of cost-effective, technically feasible design solutions for re-vegetating the area of the Site defined as "barren slopes" in the Non-Populated portion of the hillsides south of I-90 (M, F, & G, 1992). The implementation of the design elements of this plan began in the spring of 1998 when approximately 220 acres were limed at rates between 1 and 4 tons/acre. In the fall of 1998 that acreage was hydroseeded.

In the spring of 1999, EPA and the State limed an additional 700 acres of which 365 acres were subsequently hydroseeded in the fall. Additional liming and planting are planned through 2001. The soil amendments are planned to consist of organic matter, liming products, fertilizers, tackifiers, and seed mixes proven successful at the demonstration plots. These products will be applied both from land-based equipment and from the air. Beginning in 2000, hydroseeded areas will be evaluated for percent cover and vigor. The project team will revisit those areas considered to be unsuccessful and make decisions regarding new design solutions if needed.

C. Monitoring of Hillsides Performance

To ensure that the hillsides work meets the requirements of the ROD and overall project goals, a monitoring program will begin in 2000. The Hillsides Monitoring Program (Section 4.2.2) will measure suspended solids, flow, and turbidity in the drainages affected by re-vegetated areas. This approach will be used to directly determine the effect of the re-vegetation efforts on surface water quality. In addition, percent cover of vegetation will be measured and the quality of that vegetation assessed particularly with respect to its ability to regenerate naturally. Areas that do not re-vegetate with current treatments will be analyzed and treated individually according to the deficiency detected.

D. Selected Surface Armor or Soil Cover on Mine Waste Rock Dumps

The AOC (EPA, 1990) and AOC work plan describes the erosion control measures to be undertaken at the Site at five mine rock waste dumps. The proposed action varies between sites. Actual activities performed are described below; locations are shown on Figure 2:

- **Page Mine Waste Rock Dump.** The AOC required five steps that were generally accomplished for this site. The remedy was performed by ASARCO in 1992. They demolished and removed the foundations from the mill buildings and buried them under the waste rock pile as it was flattened and recontoured to more closely match the natural topography. No information was found about the actual finished slopes of the waste pile. A shot-creted spillway channel was constructed down the face of the dump to carry Silver Creek in the event of a flood where the flow exceeds the capacity of the existing buried culvert. The spillway appeared in good condition at the end of 1999.

Six inches of clean soil was placed over the regraded mine dump. The area was then hydoseeded and planted with trees. Presently, the trees planted appear to be in good condition and a minor amount of secondary vegetative growth has established under the trees. There has been no evidence of erosion of the waste rock pile itself. In general, the system appears to be performing adequately; however, it is recommended that the area be reviewed to evaluate the need for additional efforts to encourage further vegetative growth.

- **Silver Bowl Waste Rock Dump.** The AOC work plan required sampling and analysis of the soil at the site to determine appropriate soil amendments needed to enhance plant growth. Pintlar regraded the area in 1992. The area has been re-vegetated at least three times without success. The first time the plants survived two seasons with declining vigor, but had died by the third season. The area was limed and hydroseeded in 1998 and 1999 and is included in the current conceptual plan for re-vegetating the Magnet Gulch area.

- **Arizona Tunnel Waste Rock Area.** In 1998 and 1999, the Bunker Limited Partnership (BLP) removed the Arizona Tunnel waste rock pile from Deadwood Gulch and disposed the rock on the CIA. Following regrading of the affected Deadwood Gulch area, BLP lined the drainage channel with rock and limed and hydroseeded the riparian area adjacent to the creek.

- **Sierra Nevada Mine Waste Rock Dump.** Pintlar removed this waste rock pile from Deadwood Gulch except for approximately 4 to 5 feet of rock remaining on the valley floor. They then graded the dump into the hillside and re-vegetated it. Additionally, the BLP has performed restoration work above and below the rock dump area in Deadwood Gulch.

- **Wardner and Smelterville Slope Stabilization Plan.** The AOC discussed the fact that erosion of barren hillsides affected a number of residences in both towns. The document called for a detailed study and plan to be submitted by 1991. While a formal plan has not been prepared for this work, cribbing and gabion retaining structures were constructed (Pintlar, 1992). Pintlar installed approximately 160-linear feet of cribbing and 450 feet of gabion wall at the slope toe in Smelterville. In 1997, EPA and the State performed additional hillside stabilization at the base of the Smelterville hillside that consisted of cleaning out sloughed soils, reinforcing existing catchment walls, and constructing additional gabion walls to prevent sloughing soils from entering remediated yards. In 1992 in the town of Wardner, Pintlar Corporation constructed approximately 380 linear feet of cribbing along the toe of hillside slopes adjacent to remediated yards. During the summer of 1999, the USACE's infrastructure contractor restored capacity behind existing cribbing in Wardner by removing accumulated sediment and rock. Also in 1999, various isolated small mine dumps were removed from the hillside above Wardner by BLP.

E. Enforce Existing Controls on Access

Controls of access to the hillsides currently consist of locked gates across Government Gulch Road and gates across a closed portion of McKinley Avenue. The general public cannot drive up to the hillsides area from the northern portion of the site. However, long-term access restrictions are recommended to be evaluated, especially after McKinley Avenue is re-opened to the public.

F. Maintain Existing Fencing

The hillsides area is generally not fenced with the exception of a few hillside road crossings where access is limited and controlled.

G. Some or all of the Solid Waste Landfill Material May Be Relocated to the Lead Smelter Closure. Contour and Re-vegetate Disturbed Areas.

Solid waste from the lower Industrial Landfill east of Deadwood Gulch (Figure 2) was removed to the CIA in 1998. Solid waste from the upper Industrial Landfill is planned to be excavated and disposed at the Borrow Area Landfill after its completion.

H. Surface Water Flows at the Solid Waste Landfill Will Be Returned to Their Natural Conditions to the Extent Practicable

EPA graded the removal area of the lower Industrial Landfill to match existing contours. Capping was not thought necessary since the waste was removed and was not process-related and not considered hazardous. The upper landfill is planned for removal in the fall of 2000.

4.3.1.4 Hillsides Operations and Maintenance Considerations

In the short-term, operations and maintenance will be guided by the Hillsides Monitoring Program (Section 4.2.2). This program will monitor the performance of the particular elements of the Hillsides re-vegetation and stabilization activities. The results of the monitoring will be reviewed annually by the project team in order to remedy any problems with achievement of the goals and objectives of the remedy.

For the long-term, operations and maintenance for the hillsides stabilization and re-vegetation is expected to include continued monitoring for surface erosion and repair of rills if needed, cleaning out ditches and culverts on roads near slopes, inspecting check dams and repair if necessary. Vegetation should be sustainable and only need to be replaced or repaired if erosion or mass movement disturbs it in a manner that could result in degradation of the human and/or natural environment.

4.3.1.5 Assessment of Remedial Actions

A. Evaluate Remedy Performance

1. **Erosion Control Structures**

   The installation of both bench terraces and check dams was completed in 1999. EPA and the State will measure performance of current check dams beginning in 2000. Consequently, this portion of the hillsides project is too immature to make any statements specific to performance.

2. **Re-vegetation Programs**
This remedial activity is in progress. Earlier tree planting efforts by the PRPs were very successful in areas north of I-90. However, within the hillsides project area, seedling success was thought to be marginal due to the slow growth of seedlings planted. More recent observations, however, suggests that although slow growth initially occurred, the trees may have been concentrating growth on root structures that will support above ground growth when sufficient water and nutrients are obtained. The current adaptive management approach being implemented by EPA and the State focuses on the performance of the vegetation with built-in repair activities when needed. This approach is expected to address potential issues, problems or failures that may occur. Initial performance, while premature, indicates potential for successfully covering the hillside ground surfaces with vegetation sufficient to contribute to the goal of controlling erosion and increasing infiltration.

3. **Surface Armor Or Soil Cover On Selected Mine Waste Rock Dumps**
All of these sites received treatments more protective of the goal to control direct contact or erosion hazards, than was called for in the AOC. The PRPs and EPA removed most of the waste rock at these sites which provides for a more long-term treatment of the contaminants at these locations the regrading and capping remedies that had previously been planned. Additionally, the sites either were re-vegetated or are scheduled for re-vegetation as part of the general re-vegetation on-going at the site. Re-vegetation is likely to be a more long-term and sustainable treatment than a layer of soil or rock.

   In addition to the sites named in the AOC and the ROD, four other waste rock piles were removed. Two mine dumps located on the Wardner hillsides (Figure 2) were removed by BLP in 1999 and disposed in the Guy Cave depression in the Milo Creek Basin. These two mine dump areas were regraded for drainage and sprayed with tackifier. The third mine dump removed is the Wyoming Mine Dump in Grouse Gulch (Figure 2). BLP funded removal of waste rock adjacent to the creek. The area was re-sloped and the creek bed stabilized using rock to armor the banks and as check-dams across the creek profile. New sedimentation basins were also constructed and sediment that had deposited behind existing gabion dams was cleaned out. EPA and the State re-vegetated the area in 1998. A fourth tailings pile was removed from the old mill site on Grouse Gulch to the CIA. The area was also regraded and re-vegetated.

4. **Wardner and Smelterville Slope Stabilization Plan**
Cribbing was minimally to moderately successful in controlling erosion above the towns of Wardner and Smelterville. For both of the hillsides, a portion consists of weathered bedrock outcrops that naturally ravel. This raveling of rock and soil is a continual natural process that cannot be cost-effectively controlled. Gullies from the hillsides occasionally deposit sediment on resident property located at the base of both the Wardner and Smelterville hillsides. Recent analyses of soil samples from the Warder and Smelterville hillsides were an average of 5633 mg/kg and 4555 mg/kg lead, respectively (TerraGraphics, 2000). Since these hillside contamination levels are above the 1,000 mg/kg action level

for yard cleanups, it is important that sloughing from these hillsides be contained at the base of the slopes such that yards are not recontaminated. Periodic clean out behind soil catchment walls will be necessary on an as-needed basis.

In general, the potential for mine dumps to erode and impact the protectiveness of the Populated Areas of the Bunker Hill Site is considered in the Bunker Hill Populated Areas Operable Unit First Five Year Review Report. That document concludes that no further action is warranted on mine dumps at this time from a human health perspective.

For information on the impact of hillside sloughing on the protectiveness of the Populated Areas of the Bunker Hill site, refer to the Populated Areas Five Year Review Report. That document identifies areas where sloughing may be recontaminating clean portions of the Populated Areas. In addition, that document also discusses the need for local planning and zoning changes so that future development efforts on, or at the base, of hillsides do not result in further recontamination.

5. **Enforce Existing Controls On Access**
This activity is ongoing and provides some means of controlling or limiting contact with contaminants in the area. Some isolated reports have been received that the Grouse Gulch hillsides are being used by trail bikers. Should these types of uses continue, existing access controls may need to be enhanced to limit uncontrolled use.

6. **Maintain Existing Fencing**
This activity is ongoing and provides some measure of controlling or limiting direct contact with any contaminants that may be in existence in those areas.

7. **Some or all of the Solid Waste Landfill Material May Be Relocated to the Lead Smelter Closure. Contour and Re-vegetate Disturbed Areas.**
Solid waste from the lower Industrial solid waste landfill east of Deadwood Gulch was removed to the CIA in 1998. The area was regraded and hydroseeded. This treatment is believed to be protective since the waste removed was not considered hazardous.

8. **Surface Water Flows At The Solid Waste Landfill Will Be Returned To Their Natural Conditions To The Extent Practicable**
The removal area of the lower landfill was regraded and hydroseeded to match existing contours which should bring surface flows to nearly original condition. As noted in Section 4.3.1.3 H, the upper landfill is planned to be removed in the fall of 2000.

B. New Information

The workshop process discussed above approved the use of adaptive management for making decisions about short and long-term management of these steep areas. By default, this process will continually introduce and discuss new information about the performance of the hillsides in order to determine appropriate new approaches for repairing any failures that may occur.

The results of agency workshops (Appendix A) restated some of the ROD suggestions for remedial activities for the hillsides re-vegetation work. As such, these modifications will be evaluated to determine if an ESD or ROD amendment is necessary to document changes to performance standards.

C. Identify Deficiencies

None were found.

D. Recommend Improvements

1. Evaluate whether additional restrictions to site access are to prevent direct contact with contaminants.

2. Periodic inspection and, if necessary, removal of sloughed soil and rock from behind catchment walls in Smelterville and Wardner is recommended to prevent recontamination of remediated yards that are located at the base of hillsides in these communities.

3. Evaluate the need for additional efforts to encourage vegetative growth at the Page Mine waste rock dump.

4.3.2 Gulches Remedial Actions

4.3.2.1 Introduction and Background

As discussed previously, the Bunker Hill Superfund site is located in the Silver Valley of the SFCDR. This steep, mountain valley trends east to west with numerous smaller creek eroded valleys or gulches running south to north primarily on the south side of the valley. The seven gulches of primary concern cited in the ROD for remedial actions are from west to east (Figure 2):

- Grouse Gulch,
- Government Gulch,
- Magnet Gulch,
- Deadwood Gulch,
- Railroad Gulch,
- Portal Gulch, and
- Milo Gulch.

Railroad, Portal, and Milo Gulch remediations are discussed in Sections 4.3.7, 4.3.8, and 4.3.11 respectively, rather than this section. These three gulches are discussed separately because their contaminant source issues and required remedial approaches differed from the other gulches, specifically:

- Railroad Gulch: included with Boulevard Area discussions because its creek crosses the Boulevard property (refer to Section 4.3.7).

- Portal Gulch: ROD-required actions focus on mine water treatment from the Bunker Hill mine whose portal is located in Portal Gulch (refer to Section 4.3.8).

- Milo Gulch: major water piping project with multiple agency involvement and stabilization of existing mine landing area (refer to Section 4.3.11).

The remaining gulches discussed in this section (Grouse, Government, Magnet and Deadwood) focus on similar contaminant issues and similar remedial approaches (source removal actions and rebuilding/stabilization of creeks).

A. Grouse Gulch

Grouse Gulch is a small watershed located west of Government Gulch with a perennial creek (Grouse Creek) that courses through the Smelterville city limits. Past mining activities, sparse hillside vegetation, and relocation/confinement of the creek channel have all contributed to an unstable creek profile and alignment that continues to erode and convey sediment into Smelterville. Following a major flood event in 1986, Shoshone County and the Soil Conservation Service constructed four gabion dams across the creek at various locations along its length in an attempt to stabilize the creek bed profile. Past smelting and mining activities have resulted in surface contamination of the soils in the gulch area, including point sources of a mine dump and an abandoned tailing pile. These contamination sources and the unstable and eroding creek contributed to contaminated sediment being carried downstream, especially during high flow runoff events. Prior to remediations conducted in Grouse Gulch, the City of Smelterville was particularly concerned that if Grouse Creek flooded during high flow events that several remediated yards within Smelterville could be recontaminated.

B. Government Gulch

Government Gulch, the largest gulch on site, is also the historic location of several ore processing facilities. The Zinc Plant operated in Government Gulch from 1928 to 1981. Two sulfuric acid plants were constructed at the Zinc Plant in 1954 and 1966. A phosphoric acid plant was added in 1960 and a fertilizer plant was added in 1965. The Zinc Plant complex also housed a silver refinery, and mercury and cadmium processing units. A cobalt storage structure was located just upstream of the zinc plant. Several wastewater ponds (typically unlined) were also located in this gulch.

A significant amount of mine waste-rock and other random fill (up to 10-feet thick) was placed across the valley since the early 1900's in order to increase the foundation elevation of the processing facilities as well as to provide an easy means of disposing mine waste materials from processing. As a result, during the RI, much of the subsurface soils were found to be highly contaminated to about 10-feet in depth especially in the industrial parts of the gulch.

Government Creek, which historically flowed down the center of the gulch in a meandering pattern, was modified during the time of active ore processing. Above the Zinc Plant, Government Creek remained in a somewhat natural, unlined surface water channel, but was routed to flow through the zinc plant reservoir to serve as a water source for processing. From the Zinc Plant reservoir, Government Creek was then hard-piped to the western side of the gulch where it discharged into a shot-crete lined channel that flowed north past the Phosphoric Acid Plant. Once past the Phosphoric Acid Plant, Government Creek flowed back to the center of the gulch into the original natural channel. Government Creek then crosses under McKinley Avenue and continues to flow north before crossing under I-90 and discharging into the SFCDR. As part of EPA's 1990 AOC with Gulf Resources and Hecla Mining, sediment retention gabion dams were constructed in Government Creek upstream of the Zinc Plant to settle sediment from surface water prior to its continued downstream flow.

C. Magnet Gulch

Magnet Gulch, located to the east of Government Gulch, was used for various material storage and handling processes. The 13.5 acre A-4 gypsum pond located at the base of Magnet Gulch was impounded by a waste rock embankment on the north to store waste gypsum from the phosphoric acid/fertilizer plant. Above this feature a roadway embankment was constructed to enable rail transport of concentrates and ores from the mill concentrator and railroad facilities to the Smelter Complex. Later McKinley Avenue was constructed between the A-4 gypsum pond and the railroad grade. This railroad embankment impounded surface water from the gulch and formed McKinley Pond. Upstream of the railroad embankment, Magnet Gulch was filled with waste mine rock to create a storage area for smelter process by-products. This location was used to store copper dross flue dust amongst other materials. The copper dross flue dust was eventually consolidated in the principal threat materials disposal cell at the smelter closure landfill. Further upstream, a third embankment was constructed across Magnet Gulch to create the initial impoundment for waste gypsum, the A-1 pond.

With the infilling of much of Magnet Gulch to construct the A-1 gypsum pond, railroad embankment/materials storage area, and the A-4 gypsum pond, the seasonal flows of Magnet Creek were displaced from its natural channel and put into a buried 4-foot by 4-foot box culvert. The box culvert discharged into McKinley Pond (Figure 2) which tended to seep into the subgrade soils and through the A-4 gypsum pond prior to discharging as seeps through the northern A-4 embankment and into Bunker Creek. Additional creek stabilization work, primarily a sediment retention gabion dam, was constructed in 1992 as part of EPA's 1990 AOC with Gulf Resources and Hecla Mining.

Much of the native vegetation in Magnet Gulch and surrounding hillsides had been significantly adversely impacted by smelter emissions resulting in substantial surface erosion within the gulch (McCulley, Frick & Gilman, 1996).

D. Deadwood Gulch

Deadwood Gulch is located immediately east of Magnet Gulch. As Deadwood Creek leaves the gulch area, it flows beneath McKinley Avenue between the eastern edge of the A-4 Gypsum Pond and the Lined Pond prior to discharging to Bunker Creek. As a result of mining-related activities, the Deadwood Gulch corridor has also been substantially impacted from its natural state. Including having the Arizona Mine *dump totally block the gulch in the upper reaches, having vegetation destroyed by* emissions and logging resulting in severe erosion and sediment transport, and destabilization of the Deadwood Creek channel because of high flows. To lessen the impacts of some of these adverse conditions, in the early 1990's as part of EPA's 1990 AOC, Pintlar built two gabion dams across Deadwood Creek for sediment retention. The intent of these sediment dams was to slow down flow during spring run-off such that sediment could be retained within the gulch rather than flowing into downstream water systems. In the spring of 1994, the northernmost gabion dam was damaged by extensive spring run-off. Water had built up behind the dam and undermined the dam's soil foundation causing settlement across the crest of the gabion dam as well as damage and shifting of the downstream apron of the dam. The condition that caused the dam to fail and overtop (a clogged filter fabric on the upstream face of the dam) has been mitigated. The dam continues to perform adequately, and will be routinely inspected after major storms and during annual inspections.

4.3.2.2 Review of ROD, ESD, & ROD Amendment

Table 4-4 summarizes ROD and ESD requirements for the various gulch remedial actions discussed within this section. The ROD requirements for the gulches were cited amongst several general sections of the ROD rather than being summarized by specific gulch. For clarity purposes in comparing with the ROD, the ROD requirements are summarized as contained within the ROD versus by gulch.

Table 4-4
Gulch Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. Erosion control structures and sediment basins in Deadwood, Magnet and Government Gulches	Reduction of suspended sediment/contaminant loading in surface runoff to the SFCDR	Oct 1990 AOC ROD 9.2.1
2. Institutional controls	Limit direct contact with contaminants	ROD 9.2.1
3. Enforce existing controls on access	Limit direct contact with contaminants	ROD 9.2.1
4. Maintain existing fencing	Limit direct contact with contaminants	ROD 9.2.1
5. Rock and/or soil barrier on A-4 Gypsum Pond or relocate to CIA	Limit direct contact with contaminants and control migration of contaminants to surface and groundwater; Minimize infiltration through the gypsum material	ROD 9.2.5
6. Temporary dust control on material accumulation sites	Control migration of windblown dust	ROD 9.2.1
7. Channelize and line Government Creek; A natural stream channel will be developed from the upper reaches of the gulch down to Bunker Creek	*Streambed excavation goals (ESD 4-98)* *Pb - 1,000 mg/kg; As - 850 mg/kg; Zn - 1,000 mg/kg; Sb - 850 mg/kg; Hg - 850 mg/kg; Cd - 850 mg/kg - Soils above these contamination levels will be placed in the Lead Smelter Closure.*	ROD 9.2.1/ ESD 12-95/ ESD 4-98
8. Contaminated materials from the Zinc plant and Phosphoric Acid plant areas will be placed in the Lead Smelter Closure.	*Reduce potential groundwater loadings from these sources* *Upland excavation cleanup goals (ESD 4-98)* *Pb - 10,000 mg/kg; As - 850 mg/kg; Zn - 9,000 mg/kg; Sb - 850 mg/kg; Hg - 850 mg/kg; Cd - 850 mg/kg - Soils above these contamination levels will be placed in the Lead Smelter Closure.*	ROD 9.2.5/ ESD 12-95/ ESD 4-98

Table 4-4
Gulch Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
9. Place cutoff wall in upper Government Gulch to divert clean water away from contaminated areas; place cutoff wall in lower Government Gulch to collect groundwater for treatment in the collected water wetland.	Minimize contamination to SFCDR	ROD 9.2.5
10. Re-vegetate disturbed areas	Minimize erosion	ROD 9.2.5
11. Relocate A-1 Gypsum pond to CIA. A *portion of this material pile will be* relocated from Magnet Gulch to the Lead Smelter Closure.	Limit direct contact with contaminants and control *migration of contaminants to surface and groundwater;* Minimize infiltration through the gypsum material	ROD 9.2.5/ ESD 12-95
12. Install barriers consistent with land-use in remaining areas (a minimum of 6" of clean soil or other barrier will be installed if surface concentrations >1000 mg/kg Pb)	Minimize direct contact with contaminants	ROD 9.2.5
13. Permanent dust control through containment, "hot spot" removal, soil/rock barriers and re-vegetation	Minimize contaminant migration and direct contact risk	ROD 9.2.6

4.3.2.3 Description of Remedial Actions Conducted at the Site

A. Grouse Gulch

The overall goal of the Grouse Gulch remedial action was to minimize further contaminated sediment transport down the gulch and thereby reduce the potential for recontamination of previously remediated areas within the city of Smelterville and sediment load into downstream river systems.

To achieve these goals, the following work was conducted:

- Approximately 1,200 cubic yards of tailings above the uppermost gabion structure were removed from locations closest to the creek and disposed in the CIA.
- A new gabion dam was constructed in the lower reaches of the gulch to increase sediment retention time and to augment the sediment retention capacity of the existing gabion dam system in the gulch.
- Sediment that had built up behind existing gabion dams was removed to provide more capacity for future runoff events.
- The Wyoming mine dump located near the creek was buttressed at its base to minimize the potential for erosion into the creek. To increase its stability, approximately 2,000 cubic yards of mine dump material was removed and disposed at the CIA.

- Accumulated sediment and alluvium was removed from downstream portions of the creek within the Smelterville city limits to increase the flow capacity within this portion of the creek and to minimize the potential for overtopping into remediated yards.

- Access roads up through the gulch were improved to enable easier O&M of the gabion retention structures.

The Grouse Gulch remedial action was implemented in the summer of 1997 using BLP bankruptcy funds.

B. Government Gulch

Those components of the Government Gulch remedy that relate directly to the demolition of facilities located in the gulch are discussed in Section 4.3.6, Industrial Complex Remedial Action. The remedial actions discussed in this section focus on source removal measures and controlling migration of contaminants to surface and groundwater.

As part of EPA performing remedial actions at the Site, implementation strategies were developed to increase the quantity of source removals (approaches believed to have a greater positive effect on health and the environment) and also defer some aspects of remedies that appeared to have a low certainty of success or a narrow cost-benefit margin. For the Government Gulch remedial action, this specifically meant that:

- Tailings removal quantities were significantly increased (about two-fold) over those removal quantities estimated in the Feasibility Study (FS) and the ROD.

- In light of the increased source removal action, EPA and the State chose to defer construction of the ROD-specified groundwater cutoff wall located up-gradient of the Zinc Plant and the groundwater collection wall located down-gradient of Phosphoric Acid Plant. These groundwater control and collection systems are part of the long-term constructed wetland water treatment remedy described in the FS and the ROD for the Smelterville Flats area (Section 4.3.3). As discussed in Section 4.3.3, long-term water treatment and the constructed wetland treatment technology is also being deferred until the benefits of the large-scale source removal actions can be evaluated. If further treatment is determined to be necessary, additional remedial measures will be evaluated. In addition, if monitoring data indicates that the source removal actions are effective in improving surface and groundwater quality, the need for either an ESD or ROD Amendment will be evaluated to address the ROD requirement for groundwater control and collection systems.

- Because of the large-scale source removal action in Government Gulch, EPA and the State chose to defer lining Government Creek to reduce infiltration into what was to be, under the FS approach, contamination left in-place. The large-scale source removal action resulted in EPA and the State deciding to reconstruct Government Creek as a 'natural channel'. The need for either an

ESD or a ROD Amendment will be evaluated to address the ROD requirement to line Government Creek.

From 1996 through 1998, the Government Gulch remedy was implemented. This remedial action consisted of the following work components:

- **Soil Removal Action**: Nearly 700,000 cubic yards of contaminated materials (tailings, waste rock, and PTMs) were removed from the gulch extending from the upper reaches of Government Gulch down to McKinley Avenue. This quantity of removed material is over twice the amount of contaminated material that was projected to be removed under the remedy planned in the FS and ROD. Within the area of the creek channel, contaminated soil greater than 1,000 mg/kg lead was removed up to a maximum depth of 3 feet below the channel and then backfilled with clean borrow. Outside the creek channel, soils with lead concentrations greater than 10,000 mg/kg were removed and then the area received a 6-inch ICP barrier cap typical for future industrial use. Verification testing of all removal areas was conducted by the site removal verification team (RVT) (representatives of EPA, the State, and the USACE).
- **Reconstruction of Government Creek**: Government Creek was reconstructed from the upper reaches of the gulch up to approximately 2000 feet south of McKinley Avenue. Plans are in place to continue reconstruction of Government Creek from McKinley Avenue to I-90 where it flows into a culvert system under the highway in order to discharge into the SFCDR. The low flow channel of Government Creek was sized to handle a 25-year storm, with an enlarged channel section to handle the 100-year storm. The low flow channel was typically rock-lined; the flood plain channel was vegetated. Concrete and riprap grade control structures were constructed intermittently along the creek profile at major changes in grade.
- **ICP Capping and Re-vegetation**: A 6-inch clean soil ICP barrier cap was placed outside the channel floodplain area. The entire gulch area was then hydroseeded, with the exception as noted above for the rock-lined low flow channel of Government Creek. Willows were planted in riparian areas of the creek.

C. Upper Magnet Gulch – Government-Implemented Action

Similar to Government Gulch, the primary objectives of the upper Magnet Gulch remediation were to focus on increased source removal actions and reconstruction of natural surface-water flow channels. The Magnet Gulch remediation implemented by EPA and the State included:

- **A-1 Gypsum Pond Removal:** Conducted in 1995 and 1996, this action removed the gypsum and the A-1 embankment and consolidated these materials at the CIA and the Smelter Closure area.
- **Removal of Mid-Gulch Fill Materials:** The mid-gulch area below the A-1 gypsum pond was removed in 1997 to 1998. As noted above, this area of the gulch was infilled to provide material storage areas for processing by-

products and to provide space for the railroad line to the Smelter. These contaminated gulch materials were removed and consolidated in the Smelter Closure area. The EPA and State removal verification team (RVT) verified that soil removal levels had been achieved. Approximately 200,000 cubic yards of material were removed. In addition, the box culvert that the mining companies had constructed beneath the mid-gulch fill to carry the flows of Magnet Creek was located and removed.

- **Reconstruction and Re-vegetation of Magnet Creek:** In 1999, the portion of Magnet Creek above McKinley Avenue was reconstructed on native material after the source removal actions had been conducted. Because of the steepness of Magnet Gulch, erosion of the newly constructed channel was a concern resulting in three sediment retention basins being constructed along the creek's alignment to slow down water flow. The channel and banks were rock-lined to minimize erosion. Magnet Gulch was hydroseeded upon completion of the channel work.

D. Lower Magnet Gulch, Partial Removal and Capping of A-4 Gypsum Pond — PRP-Implemented Action

This lower portion of the Magnet Gulch remedial action is being performed by a PRP (Stauffer Chemical) and has not yet been completed. The ROD states that this impoundment can either be capped in-place, partially, or completely removed as long as water quality performance standards are achieved. To date, the PRPs have implemented a progressive remedial approach that proceeds in a stepwise manner. Initially, the impoundment was going to be closed by grading, capping, and re-vegetating the surface of the A-4 pond for surface water control and to minimize infiltration. Magnet Creek was to flow on top of the closed A-4 surface in a geomembrane-lined channel prior to flowing down a drop structure constructed on the face of the northern A-4 embankment before discharging into Bunker Creek. The surface capping was completed, however, the Magnet Creek channel was not water-tight as it flowed across the closed gypsum surface and leaked into the underlying gypsum material. The PRPs have since decided to remove gypsum material within the area of Magnet Creek so that the channel will be constructed on natural grade. This approach to address the leaky channel is currently being designed and is under discussion with the Agencies for their approval.

E. Deadwood Gulch

Deadwood Gulch, located to the east of Magnet Gulch, has historically had the lowest levels of contamination in its surface water compared to the other major gulches at the Site. This was thought to be a result of the relative lack of industrial mining activity that took place in Deadwood Gulch in comparison with Government and Magnet Gulches. The Arizona Mine dump filled the narrow valley of Deadwood Gulch it its upper reaches. In addition to the Arizona Mine Dump, various mine adits/portals surfaced in Deadwood Gulch that occasionally discharged groundwater seepage. Other than these point sources of contamination, Deadwood Gulch contamination was primarily from the erosion of adjacent hillside soils that had become contaminated with smelter emissions. The Arizona Mine Dump that blocked the upper reaches of Deadwood Creek also resulted in significant quantities of rock bed load being transported downstream during run-off events.

To address the levels of contamination and the erosion damage in Deadwood Gulch, the following remedial actions were conducted:

- **Gabion Dam Sediment Removal:** In 1995 and 1996, sediment that had collected behind the gabion dam retention structures was removed. The sediment was tested for contaminant levels and was found to be below cleanup goals enabling the sediment to be spread out along areas outside the creek bed and then hydroseeded. Since erosion continues in Deadwood Gulch, it is anticipated that periodic sediment removal behind the gabion dams will likely be required until the hillside re-vegetation and the creek stabilization efforts become more stable.
- **Creek Stabilization:** Creek stabilization work was conducted in 1998 using BLP remediation funds. The activities consisted of constructing small cobble and boulder grade check dams perpendicular to the creek flow about every 200 to 300 feet. The purpose of the check dams was to slow stream flow down, to drop out sediment/bedload, and to minimize erosion of creek banks on meander curves. Typically the check dams were 1.5 to 2 feet high, a couple feet wide, and spanned perpendicularly across the channel.
- **Removal of Arizona Mine Dump:** The Arizona Mine Dump was removed and hauled to the CIA for disposal in 1997 and 1998. Approximately 500,000 cubic yards of material was removed such that a reconstructed streambed could be constructed in the previously blocked portion of Deadwood Gulch. The mine waste rock removed to the CIA was put to beneficial use as haul road surfacing on top of the CIA.
- **Lower Deadwood Creek Reconstruction:** Lower Deadwood Creek from the first gabion down to a sedimentation basin just south of McKinley Avenue was reconstructed in 1996 and 1997 using the BLP remediation fund. New culverts were installed under McKinley Avenue in lieu of the existing under-sized box culvert. A site PRP (Stauffer Chemical) constructed a heavy riprap channel from the north side of the McKinley Avenue culvert down to Bunker Creek in the steep portion between the A-4 Gypsum Pond and the Lined Pond.

4.3.2.4 Operations and Maintenance Considerations

The O&M manual for the gulches discussed in this section is in the process of being developed. However, some maintenance issues that should be expected include:

- Seasonal inspection and clean out of culverts and gabion dams.
- Inspection and repair, if necessary, of creek beds for erosion, piping around riprap, and grade structures.
- Inspection and cleanout of sedimentation ponds and disposal of sediments.

- Inspection and repair, if necessary, of vegetated areas.
- Inspection and repair, if necessary, of caps.

4.3.2.5 Assessment of Gulch Remedial Actions (Grouse, Government, Magnet, Deadwood)

A. Remedy Performance

Remedy performance for the gulch actions can be judged based on whether the remedy satisfies the following intent of the ROD and ESD documents:

- Stable non-eroding surface water channels
- Contaminated soil either capped or removed such that migration to surface and groundwater is substantially minimized
- Vegetation reestablished sufficiently such that surface water runoff will not erode caps
- A sufficient amount of contaminated source material removed such that groundwater contamination levels decrease with time.

At this time, none of the gulch remedial actions have been completed for more than 1 or 2 years, such that it is premature to judge whether remedy performance has been achieved. In addition, in many areas, additional actions are still required (i.e., riparian plantings for most gulches).

It is however recommended that routine surveys be conducted to evaluate channel and cap stability, success of vegetation, and surface water and groundwater quality. These surveys will then provide data for the next 5-year review.

B. New Information

No new information became evident during this 5-year review.

C. Identify Deficiencies

No deficiencies were evident during this 5-year review. Some components of the remedy have not yet been initiated (e.g., riparian planting of Government and Deadwood Gulches), however, this is not considered a deficiency.

D. Recommended Improvements

No improvements to the gulch remedies are recommended at this time.

4.3.3 Smelterville Flats Remedial Action

4.3.3.1 Introduction and Background

Mining companies constructed the first mill at the Bunker Hill Complex in 1886 to process locally mined lead, zinc, silver and other metals. Metals processing expanded and continued until 1981. Before the widespread use of ponds to contain tailings, mining companies often disposed of tailings on the valley floor and in local surface waters. The SFCDR received tailings in this manner from numerous mines and mills in the Silver Valley (see Sections 2 and 3). A wood plank dam was constructed across the Pinehurst Narrows to retain tailings within the floodplain of the SFCDR. Failure of dam and subsequent flooding resulted in a portion of the tailings being spread downstream.

For the purposes of describing this remedial action, the boundaries of the Smelterville Flats area (Flats) are the northern bank of the SFCDR floodplain, Pinehurst Narrows to the west, the town of Smelterville on the south and the I-90 West Kellogg interchange on the east (Figure 2).

4.3.3.2 Review of ROD, ESD, & ROD Amendment Requirements

Remedial actions for the Flats area as prescribed in the 1992 ROD and the 1998 ESD are listed below:

Table 4-5
Smelterville Flats Remedial Actions

ROD and ESD Requirements	Remedial Action Objective/Goal	Document
1. Rock/vegetation barriers on truck stop and RV park	Minimize direct contact	ROD 9.2.2
2. Temporary dust control during remediations; re-vegetate as part of long-term solution	Minimize surface water erosion and wind dispersion of contaminants	ROD 9.2.2
3. Soil or rock barriers on exposed contaminated soils and tailings that cannot be re-vegetated	Minimize direct contact	ROD 9.2.2
4. Remove tailings as necessary for natural wetland and floodway construction	Control migration of contaminants to surface and groundwater, minimize the potential need for future water treatment	ROD 9.2.2
5. Construct groundwater treatment wetland system upstream of Pinehurst Narrows	Control migration of contaminants to surface and groundwater	ROD 9.2.2
6. Construct collected water wetland treatment system	Treatment of specific surface waters collected at the Site, reduction of contaminants to SFCDR	ROD 9.2.2
7. Treatment Wetlands, if constructed will most likely be located in an area different from Smelterville Flats	Treatment of specific surface waters collected at the Site, reduction of contaminants to SFCDR	ESD 4-98
8. Construct floodway for SFCDR	Minimize surface water erosion and sedimentation	ROD 9.2.2
9. Runoff controls will be constructed south of I-90 in areas expected to be developed and paved	Minimize infiltration and percolation into underlying contaminants	ESD 4-98

A. **Final Design Solutions for the Flats**

Ultimately, many of the potential design solutions for the Flats were significantly modified. As part of the State Superfund Contract, an agreement was reached to emphasize source removal actions as an initial response over treatment systems in the Flats and Gulches areas (refer to Section 3.5). This resulted in two significant changes to the design of the Flats project. First, near total removal of the tailings in the Flats was determined to be the most cost-effective method to reduce the potential need for groundwater and surface water treatment-based remedial actions. Consequently, tailings were removed at quantities that greatly exceeded those directed to be adequate by the ROD. EPA and the State of Idaho removed over 70 percent more tailings volume from the Flats than that originally proposed as adequate to protect human health and the environment within the ROD (shown as Remedial Element #4 in Table 4-5). Second, EPA and the State decided that increased source removals would also occur in Government Gulch.

As a result of the large-scale source removals in both the Flats and Government Gulch, EPA and the State decided to defer construction of the groundwater and surface water wetland treatment systems that the ROD requires to be constructed in the Flats in order to evaluate if the increased focus on source removal will reduce and/or eliminate the need for further treatment.

When EPA took over the Site in 1995, subsequent bench studies by the U.S. Bureau of Mines showed that the technical approach for the constructed wetlands was not viable on a year-round basis for the desired water quality discharge requirements (CH2M HILL, 1996). Bench-scale laboratory studies were performed by the Bureau of Mines specifically to test this treatment process on Bunker Hill mine water. The bench scale program did not achieve treatment objectives (USBOM, 1998).

If in the future, further treatment is determined necessary, the results of the constructed wetlands treatment study will be re-evaluated, as well as other types of treatment.

As a result of this 5-year review, EPA will evaluate the need for an Explanation of Significant Differences or ROD Amendment to address the increased tailings removal on the Flats and the decision to defer construction of the groundwater and surface water wetland treatment systems.

4.3.3.3 Description of Remedial Actions Conducted at the Site

A. Rock/Vegetation Barriers on Truck Stop and RV Park

The truck stop and RV park are located north of the SFCDR and east of the Theater Bridge (Figure 2). Pintlar capped both of these areas in the early 1990s. However, the material used for the cap was too high in arsenic to be acceptable. In 1996 to 1997, additional clean material was placed on the RV park (Chavez, 2000). Recapping of the truck stop area has been partially accomplished with a 6-inch layer of topsoil placed over the portion of the property owned by the truck stop. This area will eventually be seeded and used as a picnic area (Chavez, 2000).

B. Temporary Dust Control during Remediations; Re-vegetate as Part of Long-Term Solutions

During the tailings removal actions on the Smelterville Flats, dust suppression techniques were used during construction to minimize the amount of dust dispersion. Haul roads to the CIA were also watered to control dust. As part of the long-term remediation, all areas surrounding the SFCDR upper bank and throughout much of the reconstructed floodplain were hydroseeded. Riparian plantings consisting of trees and shrubs are scheduled for installation during 2000 to 2001.

C. Soil or Rock Barriers on Exposed Contaminated Soils and Tailings That Cannot Be Re-Vegetated

EPA and the State removed tailings from the SFCDR floodplain in 1997 and 1998. A 6-inch to 8-inch layer of native topsoil was placed over areas where contamination remained and where material was too coarse to support vegetation.

Capping of remaining contaminated soils was intended to prevent direct contact with the contaminants by humans and animals. However, increased removal of tailings in the floodplain significantly reduced this environmental issue.

D. Remove Selected Jig Tailings as Necessary for Natural Wetland and Floodway Construction

EPA and the State have removed nearly all of the tailings within the Flats area north of I-90 and transported these materials to the CIA for disposal.

Soil removal actions in the Flats were performed with the intent of maximizing source control via contamination removal. To that end the decision was made to remove as much mine waste tailings as possible to the CIA for containment. Several test pit investigations and borings performed during the RI and remedial design phases of the project found the depth of tailings to be highly variable. They extended from one foot to 8 feet below the ground surface. The project team linked these results to visual identification of tailings and native alluvium by a Removal Verification Team (RVT). Representatives of the EPA, IDEQ, and the USACE formed the RVT. The RVT acted in conjunction with verification sampling to determine how much contaminated material should be removed from any given area. Lab analysis identified the levels of lead and zinc within verification samples. If necessary, further excavation occurred beyond the level established by visual inspection based on these sample analyses. The project team determined that removal of tailings to a level cleaner than the sediments carried by the river was impractical (Hudson, 2000, Zilka/Peterson, 2000). Consequently, the RVT set 3,000 mg/kg lead and 3,000 mg/kg zinc as removal goals. These are the concentrations found in the sediments typical of the SFCDR as documented in the RI (McCulley, Frick, and Gilman, 1992). It should be noted that the 3,000 ppm removal goals for lead and zinc are not requirements of the ROD and were used on a site-specific basis for the Smelterville Flats removal actions only.

E. Construct Floodway for SFCDR

The ROD further directed river work to improve groundwater and surface water quality by protecting sediments and remaining contamination from transport during flood events. The ROD also stressed erosion prevention. The ROD discusses how improvement to aquatic habitat could occur as part of the remedial design solution. Performance standards for the low-flow channels and floodplain were established in CH2M HILL (1996) as:

- Convey the estimated 2-year and 100-year recurrence-interval peak flows without increasing water surface elevations upstream of the Theater Bridge beyond those that would occur for this flow under existing conditions.
- Maintain the current level of flood protection for I-90 and the airport for the 100-year recurrence-interval peak flow.
- Eliminate impact to current flood flows in the SFCDR downstream of the project area.
- Develop a "stable" low-flow channel and floodplain system, keeping the low-flow channels along the northern part of the valley similar to existing conditions.
- Ensure that the reach of the SFCDR affected by these remedial activities has post-remedial action characteristics consistent with a functioning native species fishery.
- Control sediment during construction to avoid adverse impacts to SCFCDR biota to the extent practicable.
- Minimize erosion after construction is completed.

Specific remedial work consisted of:

- Grading back the riverbanks.
- Armoring the lower bank with riprap.
- Creating a flatter sloped upper bank protected with a combination of riprap, growth media and live branch plantings.
- Construction of spillways and sills in the river channel.
- Construction of low flow channels and overflow channel in the floodplain.
- Reseed native, organically enriched topsoils across much of the Flats.

The river stabilization was constructed in 1997 through 1998.

F. South of I-90 Tailings Removals

Tailings were also removed south of I-90 as part of the Smelterville Flats remedial action. The tailings removal areas are designated as the West End and West County removal areas (Figure 2). The West End area is a narrow strip of land bounded on the north by I-90, on the west and south by the UPRR right-of-way, and on the east by the City of Smelterville wastewater lagoons. The West County area is also bounded on the north by I-90, on the west by the Smelterville wastewater lagoons, on the south by the UPRR and on the east by the right-of-way of "Silver Road".

Tailings were removed in these areas until alluvium was reached, generally between depths ranging from 5 to 10 feet, and were hauled to the CIA for disposal. The areas were regraded for drainage purposes and clean borrow soil from the Borrow Area

B. Discuss New Information

As stated in Section 4.3.3.2, the bench scale constructed wetlands treatment study conducted by the Bureau of Mines in 1998 indicated that the constructed wetlands treatment process as currently configured would not be optimal to treat metals-laden water under site conditions and required discharge requirements.

The SAMP is intended to provide an approach to cooperatively manage the Flats and to integrate new information into decision-making in the future.

C. Identify Deficiencies

As noted above in Section 4.3.3.6 A, the truck stop portion of the RV Park is still in need of re-capping.

D. Recommend Improvements

It is recommended that the Flats area be included in future biological monitoring of plant and wildlife that is planned to begin in 2000 under an inter-agency agreement between EPA and the U.S. Fish and Wildlife (Section 4.2).

4.3.4 Central Impoundment Area Closure

4.3.4.1 Introduction and Background

The CIA area was originally constructed in 1928 as the Bunker Hill Mine tailings impoundment. The upstream method of impoundment construction was used to raise the height of the exterior dikes as new tailings were placed. The entire structure was constructed over river gravel and a 1 to 5-foot thick layer of jig tailings.

The CIA was operated in a manner similar to a dewatering pond in that it was intended to accept slurries and saturated materials, allowing the liquid to drain through the dikes and ultimately discharge to groundwater or surface waters. Tailings, gypsum, and some mine waste were delivered to the CIA as slurry. Other materials were discharged as liquid or dumped from trucks on the more stable areas.

As shown in Figure 4, the CIA is composed of three cells defined by area and material placed. The West Cell contains primarily granulated slag from the Lead Smelter, the Middle Cell contains gypsum by-product from the production of phosphoric acid and overlies flotation tailings, and the East Cell contains primarily flotation tailings from the Bunker Hill Concentrator. The Middle and East Cells are separated by a buried dike, which extends to the surface. The surface area of the top of the CIA is about 260 acres.

Disposal of operational and process waste streams on the CIA was mostly discontinued when the Bunker Hill mine was shut down in 1982. However, the Central Treatment Plant (CTP) continues to the present to dispose sludge to one pond on the CIA. Additionally, for many years, the top of the CIA provided mine water storage prior to treatment at the CTP, either in the decant pond or flooding the entire East Cell (Figure 4). The last time the CIA was flooded by mine water was in the winter of 1995 (CH2M HILL, 1996).

As discussed above, the tailings were often placed in the CIA as slurry. It has been hypothesized that the water from these slurries, as well as water impounded on top of the CIA in unlined ponds, has resulted in an isolated location of seepage from the CIA to the north and into the SFCDR, referred to as the "CIA seeps". However, this hypothesis has not been conclusively proved and other potential sources of seepage may be contributing to contaminant loading to the SFCDR. Specifically, the area where the CIA has been constructed is part of the old river channel of the SFCDR and as a result, the base of the CIA lies on top of a gravel alluvial layer. It has also been hypothesized that seepage beneath the CIA may come from tributary creek sources on the Site (e.g., Magnet and Deadwood Creeks) that have a portion of their subsurface flow moving beneath the CIA into the SFCDR. At times when the river stage of the SFCDR is high (during spring run-off, for instance), the CIA seeps are not visible, but otherwise in low river water conditions, the seep locations into the SFCDR can be visually observed.

4.3.4.2 Review of ROD, ESDs and ROD Amendment

Table 4-6 summarizes ROD and ESD requirements for the Central Impoundment Area remedial action.

Table 4-6
Central Impoundment Area Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. Temporary dust control measures	Minimize releases from this source	ROD 9.2.3
2. Institutional controls	Prevent direct contact	ROD 9.2.3
3. Collection of upper zone groundwater in CIA seep area for wetland treatment	Maximize efficient interception of contaminated groundwater from the "CIA seeps"	ROD 9.2.3 ROD 9.2.10
4. Repository for consolidation of tailings, gypsum, and other non-principal threat materials removed as part of site removals. Consolidation of Industrial Waste Landfills to the CIA. Consolidation of Arizona Mine Dump rock to the CIA. Limited quantities of mine waste from other areas of the Coeur d'Alene Basin may be disposed in the CIA.	Prevent direct contact and minimize infiltration through contaminated media.	ROD 9.2.3 ESD 4-98 ESD 4-98 ESD 4-98
5. Close CIA without removing approximately 30,000 cubic yards of suspected principal threat materials that were placed in the CIA by the PRPs in 1982.	Increased protectiveness is provided by a lower permeability cap ($1X10^{-7}$ cm/sec), that is specified in the ROD.	ESD 4-98
6. Close CIA with a cap having a hydraulic conductivity of $1X10^{-6}$ cm/sec or less, and re-vegetate.	Minimize infiltration and control erosion.	ROD 9.2.3

was placed to bring the excavations to a suitable grade for long-term drainage. The remediated areas were revegetated protect the surface cap and to minimize erosion.

Further tailings removal actions to the east of these areas were not conducted by EPA and the State as these properties were either already capped, were owned by PRPs of the site, or were currently under high use by community industrial businesses. In lieu of tailings removal actions in these areas, EPA and the State chose to conduct surface water drainage improvements to minimize infiltration into the underlying tailings (as described below).

G. South of I-90 Runoff Control and Capping

Improvements to runoff control and capping of tailings remaining in-place after the West County and West End removal actions are planned for developable areas immediately south of I-90 near Smelterville in order to minimize percolation of runoff into the underlying contaminants (EPA, 1998). Runoff control measures are intended to reduce the potential for metals leaching into groundwater. The cap will conform to ICP requirements and prevent direct contact with contaminants and minimize the potential for windblown dispersion of dust. Remedial design for this activity is currently ongoing with construction slated for the summer of 2000.

Runoff control will be achieved by regrading the area and constructing a vegetated swale and storm-drain pipe parallel to I-90. The conveyance will transport stormwater from just south of I-90 and west of the Smelterville interchange approximately 6,500 feet west to a newly constructed sedimentation pond in the West End removal area (Figure 2). The majority of the stormwater conveyance will be in a swale, with the portion adjacent to the Smelterville wastewater treatment ponds in a buried pipe. Tailings beneath the profile of the swale will be over-excavated to a depth of 2 feet below the final grade of the swale and backfilled with clean (less than 100 mg/kg lead) soil and growth media and then vegetated. The properties through which the storm conveyance will run and from which tailings were not removed will be capped with a minimum of 6-inches of rock to prevent direct contact with tailings and reduce dust generation.

The project team is designing this remedial action to work in conjunction with future anticipated development of these properties.

4.3.3.4 SAMP - Maintain the Integrity of the Remedy with Future Uses

To protect the integrity of the remedy implemented in the Flats, the State of Idaho is preparing a Special Area Management Plan (SAMP). The plan is intended to establish common understanding of the Flats remediation, interaction with future development, long-term floodplain function, and establishment of a streamlined permitting process for future activities. The decision to develop such a plan was adopted in the 1998 ESD (EPA, 1998).

The intent of the SAMP is to provide a comprehensive, long-term approach to resource and floodplain management that considers all stakeholder interests within the Flats area. The SAMP will provide a common vision for the Flats to improve permitting of local development while recognizing the functional role of floodplain and other natural resources. This will improve predictability for development interests and local governments without sacrificing environmental function. The SAMP helps assure agencies that impacts are identified, acknowledged, and accepted as part of an overall strategy for final Flats configuration, stabilization, and function (Bourque, 1997).

The removal action performed in the Flats resulted in excavation of approximately 45 acres of land previously outside the 100-year floodplain (north along the airport) to below the 100-year floodplain elevations. Although the positive results of reduced metals loading to the SFCDR, floodplain stabilization, and enhanced aquatic and wildlife habitat, are expected, some long-term concerns remain. These include:

- Ability of the floodplain to naturally stabilize within a reasonable time frame.
- Continued metals contribution from remaining tailings.
- Protection of the Shoshone County Airport.
- Loss/impact of currently developable County property.

As part of the SAMP, an interagency group will oversee preparation of a master plan for the Flats to address these concerns. The participating agencies and officials will include: Shoshone County, the City of Smelterville, IDEQ, Idaho Department of Water Resources, USACE, U.S. Federal Emergency Management Agency, EPA, BLM, U.S. Fish & Wildlife, Idaho Fish and Game, and the Coeur d'Alene Tribes. A primary goal of this group is a common understanding of interim and final cleanup concepts, stabilization, and restoration within the context of current and future floodplain work. In recognizing these aspects, this group will develop an interagency agreement, through the SAMP, that produces a strategy for land use within the Flats area.

The SAMP team will identify several jointly beneficial actions and management options such as:

- Capping remaining tailings with impervious structures, buildings, and pavement to prevent infiltration into tailings while providing for development.

- Enhanced protection of the Shoshone County Airport with expanded development along the northeast corner of the Flats.

- Floodplain stabilization off-sets by developers to fund subsequent floodplain activities.

- Higher public awareness of the beneficial function of the restored floodplain

4.3.3.5 Operations and Maintenance (O&M)

Long-term O&M for the Flats is the responsibility of the State of Idaho. The State will take over this aspect when the remedy is determined to be complete. Monitoring of the Flats will occur during an interim 3-year period (CH2MHILL, December 1996). After this period, the formal transfer of responsibility to the State from EPA will occur. Although willows will not yet have been planted, the 3-year stabilization period is scheduled to begin October 15, 1999 (TerraGraphics, 1999a).

The focus of the O&M interim period is to:

- Create an O&M plan for the Flats and develop the State of Idaho's process for implementing O&M activities.

- Implement O&M activities and monitor the achievement of interim and long-term performance standards for the Flats.
- Revise, as necessary, the performance standards and interim O&M manual and procedures for the Flats to reflect the experience gained and lessons learned during the interim period.
- Demonstrate the achievement of all final performance standards for the Flats.

Work on the interim O&M plan for this area is in progress. Currently, a draft interim O&M Manual (TerraGraphics, 1999a) is being prepared which includes scheduled and unscheduled O&M requirements, repair standards and authorization, equipment and personnel requirements, refinements and modifications, and other considerations such as regulations, unresolved decisions, and equipment and personnel substitutions.

IDEQ and EPA prepared the Draft O&M Manual for the Flats. The agencies chose the Flats area for the first O&M Manual because remedial activities in this area are very close to completion. Lessons learned from its development will be applied to the completion of the remaining O&M Manuals (TerraGraphics, 1999b)

Specific items that will need to be performed under Operations and Maintenance include inspection and repair if required of:

- **Riverbanks**: Check for bank erosion, bare ground, vegetative cover, riprap condition.
- **Sills**: Check for structural condition, downstream scour, lateral erosion, head cutting, deposition, and flow control.
- **Spillways**: Check for debris, riprap condition, headcutting.
- **Floodplain**: Check vegetative cover.
- **Floodplain Berm**: Check for structural condition and vegetative cover.
- **Wetland Ponds**: Check for vegetative cover and deposition.
- **Wetland and Upland Re-vegetation Areas**: Check vegetative cover.

4.3.3.6 Assessment of Remedial Actions Conducted at the Site

A. Evaluate remedy performance

1. **Rock/vegetation barriers at truck stop and RV Park.**
The RV Park remediation has been certified as complete (Chavez 2000). The area used as a truck stop is still in need of re-capping.

2. **Temporary dust-control during remediation; re-vegetate as part of long-term solutions.**
This remedial activity is in progress. The 'Emerald Pond' area just west of Theatre Bridge (Figure 2) was one of the first completed areas of tailings removal and reconstruction. This area shows a significant amount of natural wetland vegetation that has occurred without planting. The response of Emerald Pond to the reworking of the Flats appears very favorable. Grasses and forbs were hydroseeded throughout the Flats area to begin establishment of herbaceous

cover. Additional herbaceous work is not expected to begin until there is an opportunity to see how nature responds to the soils and hydrological regime that has been created elsewhere on the Flats.

3. **Soil or rock barriers on exposed contaminated soils and tailings that cannot be re-vegetated.**
   This remedial action is still in progress. Surface barriers, particularly in the East of Theater Bridge area of the SFCDR, are placed in lieu of complete removals. The choice of soil or rock barriers depends on future land use. High flows of the SFCDR have not been experienced since installation and may cause changes that will require repair or re-evaluation of the remedy. The highest flows generally occur in late winter and early spring and should provide needed information as to the performance of the remedy over the 3-year interim O&M interval.

4. **Remove selected jig tailings as necessary for natural wetland and floodway construction.**
   As discussed in Section 4.3.3.2 A, over 70 percent more tailings were removed from the Flats area than was identified in the ROD (1.2 million cubic yards versus 700,000 cubic yards). The larger scale removal is expected to result in less migration of contaminated sediment to surface water and groundwater in the Flats area. Performance monitoring will continue to determine the effects of this larger scale removal action in relation to water quality improvement at the Site. As noted previously, if the large-scale removal actions do not improve water quality to desired levels, water treatment or other remedial alternatives will be evaluated.

5. **Construct floodway for SFCDR.**
   Construction was performed as designed. The stabilization project is still in progress, as the upper bank planting and riparian plantings have not yet been installed. Evaluation of the floodway's success relative to its performance standards should be made after the 3-year interim period to take into consideration plant establishment and seasonal flow fluctuations.

6. **South of I-90 Tailings Removals.**
   The tailings removal project in the West End and West County areas is protective in that, as much as practicable, tailings were removed down to natural alluvial gravels. Water quality is expected to improve over time since these tailings are removed and no longer in contact with infiltrated water or the fluctuation of the groundwater table. The surface cap placed on top of the removal grade provides for controlled surface water drainage and support vegetation to minimize erosion.

7. **South of I-90 Runoff Control and Capping**
   This project will be constructed during the summer of 2000. The design criteria established for this action (over-excavating tailings beneath the runoff control channel (swale) by 2 feet and placement of a minimum 6-inch thick cap across the property sites) are expected to provide an adequate level of protection from direct contact with contaminants and a reduction of contaminant migration into the underlying groundwater.

B. Discuss New Information

As stated in Section 4.3.3.2, the bench scale constructed wetlands treatment study conducted by the Bureau of Mines in 1998 indicated that the constructed wetlands treatment process as currently configured would not be optimal to treat metals-laden water under site conditions and required discharge requirements.

The SAMP is intended to provide an approach to cooperatively manage the Flats and to integrate new information into decision-making in the future.

C. Identify Deficiencies

As noted above in Section 4.3.3.6 A, the truck stop portion of the RV Park is still in need of re-capping.

D. Recommend Improvements

It is recommended that the Flats area be included in future biological monitoring of plant and wildlife that is planned to begin in 2000 under an inter-agency agreement between EPA and the U.S. Fish and Wildlife (Section 4.2).

4.3.4 Central Impoundment Area Closure

4.3.4.1 Introduction and Background

The CIA area was originally constructed in 1928 as the Bunker Hill Mine tailings impoundment. The upstream method of impoundment construction was used to raise the height of the exterior dikes as new tailings were placed. The entire structure was constructed over river gravel and a 1 to 5-foot thick layer of jig tailings.

The CIA was operated in a manner similar to a dewatering pond in that it was intended to accept slurries and saturated materials, allowing the liquid to drain through the dikes and ultimately discharge to groundwater or surface waters. Tailings, gypsum, and some mine waste were delivered to the CIA as slurry. Other materials were discharged as liquid or dumped from trucks on the more stable areas.

As shown in Figure 4, the CIA is composed of three cells defined by area and material placed. The West Cell contains primarily granulated slag from the Lead Smelter, the Middle Cell contains gypsum by-product from the production of phosphoric acid and overlies flotation tailings, and the East Cell contains primarily flotation tailings from the Bunker Hill Concentrator. The Middle and East Cells are separated by a buried dike, which extends to the surface. The surface area of the top of the CIA is about 260 acres.

Disposal of operational and process waste streams on the CIA was mostly discontinued when the Bunker Hill mine was shut down in 1982. However, the Central Treatment Plant (CTP) continues to the present to dispose sludge to one pond on the CIA. Additionally, for many years, the top of the CIA provided mine water storage prior to treatment at the CTP, either in the decant pond or flooding the entire East Cell (Figure 4). The last time the CIA was flooded by mine water was in the winter of 1995 (CH2M HILL, 1996).

As discussed above, the tailings were often placed in the CIA as slurry. It has been hypothesized that the water from these slurries, as well as water impounded on top of the CIA in unlined ponds, has resulted in an isolated location of seepage from the CIA to the north and into the SFCDR, referred to as the "CIA seeps". However, this hypothesis has not been conclusively proved and other potential sources of seepage may be contributing to contaminant loading to the SFCDR. Specifically, the area where the CIA has been constructed is part of the old river channel of the SFCDR and as a result, the base of the CIA lies on top of a gravel alluvial layer. It has also been hypothesized that seepage beneath the CIA may come from tributary creek sources on the Site (e.g., Magnet and Deadwood Creeks) that have a portion of their subsurface flow moving beneath the CIA into the SFCDR. At times when the river stage of the SFCDR is high (during spring run-off, for instance), the CIA seeps are not visible, but otherwise in low river water conditions, the seep locations into the SFCDR can be visually observed.

4.3.4.2 Review of ROD, ESDs and ROD Amendment

Table 4-6 summarizes ROD and ESD requirements for the Central Impoundment Area remedial action.

Table 4-6
Central Impoundment Area Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. Temporary dust control measures	Minimize releases from this source	ROD 9.2.3
2. Institutional controls	Prevent direct contact	ROD 9.2.3
3. Collection of upper zone groundwater in CIA seep area for wetland treatment	Maximize efficient interception of contaminated groundwater from the "CIA seeps"	ROD 9.2.3 ROD 9.2.10
4. Repository for consolidation of tailings, gypsum, and other non-principal threat materials removed as part of site removals.	Prevent direct contact and minimize infiltration through contaminated media.	ROD 9.2.3
Consolidation of Industrial Waste Landfills to the CIA.		ESD 4-98
Consolidation of Arizona Mine Dump rock to the CIA.		ESD 4-98 ESD 4-98
Limited quantities of mine waste from other areas of the Coeur d'Alene Basin may be disposed in the CIA.		
5. Close CIA without removing approximately 30,000 cubic yards of suspected principal threat materials that were placed in the CIA by the PRPs in 1982.	Increased protectiveness is provided by a lower permeability cap ($1X10^{-7}$ cm/sec), that is specified in the ROD.	ESD 4-98
6. Close CIA with a cap having a hydraulic conductivity of $1X10^{-6}$ cm/sec or less, and re-vegetate.	Minimize infiltration and control erosion.	ROD 9.2.3

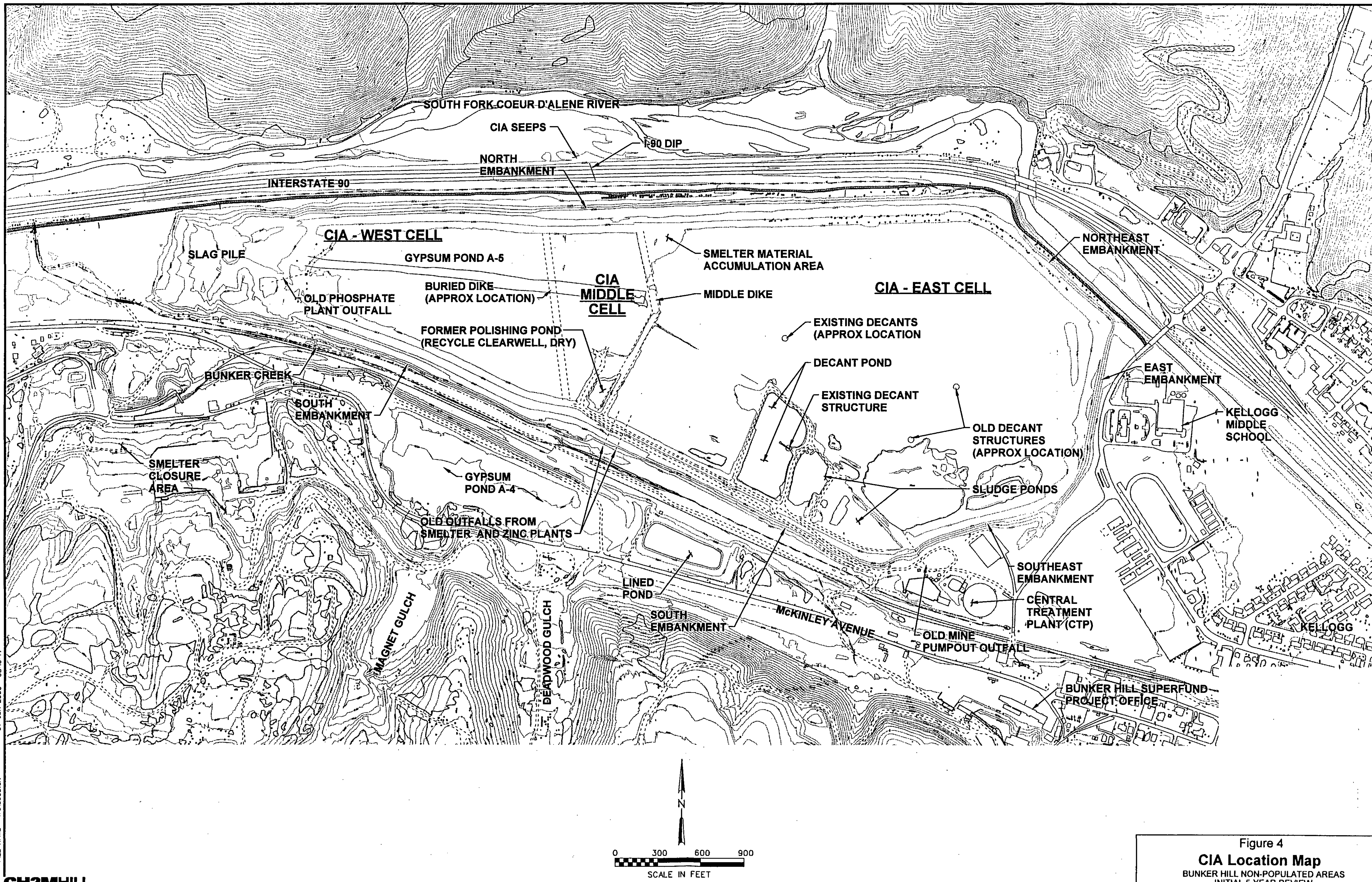


Figure 4

CIA Location Map

BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

4.3.4.3 Description of Remedial Actions Conducted at the Site

A. Temporary Dust Control Measures

In 1995, Pintlar rocked the majority of the East and Middle Cells of the CIA for the purposes of minimizing air-borne dust from the CIA. During the government-implemented remedies, construction dust was also suppressed by watering the CIA and applying chemical sprays to inhibit dust (MK, 1999). The geomembrane cover placed on the CIA and the vegetating and rocking the exterior slopes are permanent means to mitigate dust from the CIA.

B. Institutional Controls

As stated earlier (Section 4.1.2), one of the primary goals of the ICP is to prevent direct contact between humans and the remaining contamination. Several aspects of the CIA remedial action address this concern. A geomembrane cover system and vegetated surface will prevent direct exposure on the top of the CIA and the side slopes will either be rocked or revegetated to prevent direct contact. In addition, the area is entirely fenced to prevent unauthorized access.

C. Collection of Upper Zone Groundwater In CIA Seep Area For Wetland Treatment (Install System To Recover And Treat Contaminated Groundwater Surfacing North Of The CIA Through CIA Seeps. Convey to Constructed Wetland Treatment System.)

As part of remedial design, CH2M HILL conducted an evaluation of the feasibility of collecting the CIA seepage in the upper groundwater zone (CH2M HILL, 1996b). This evaluation indicated that it was not cost effective to collect and treat the CIA seeps, primarily because a collection system would intercept a larger portion of upstream groundwater than the actual CIA seeps. In addition, engineering analyses indicated that once the CIA cap is completed and stormwater controls are in place, that the ongoing consolidation of the tailings in the CIA and gravity drainage of the water in the tailings would decrease over time such that 90 percent of the seepage in the CIA tailings pile would have drained in 10 to 15 years without active collection (CH2M HILL, 1996b). Based on these evaluations, EPA and the State decided to defer construction of a seep collection system and instead will monitor the seeps after placement of the CIA geomembrane cap to evaluate whether the seepage flow is significantly reduced or eliminated over time.

Based on the above, EPA will evaluate the need for an Explanation of Significant Differences or ROD Amendment to address the deferment of construction of a seep collection system.

D. Close CIA, Soil/Clay Cap, Re-Vegetate after Emplacement of Jig Tailings from Smelterville Flats

Approximately 1.2 million cubic yards of material from the Smelterville Flats, additional material from the mine waste dumps and gulches, and a layer of slag has been placed on the CIA as of the end of November 1999. No additional materials will be placed there. The surface has been brought to grade, the subgrade prepared, and compaction was achieved. The outer perimeter dikes have been graded, rock cover placed, toe sloping done, top of dike sloping completed, and a lot of slag placed to date. The surface has been graded and the drainage channels installed. Cover installation is expected to be complete by the end of the 2000 construction season.

E. Limited Quantities of Mine Waste from Other Areas of the Coeur d'Alene Basin May Be Disposed Of In the CIA

During 1999, residential soil from EPA's yard removal program in the Coeur d'Alene Basin was deposited in the CIA. In addition, some contaminated soil from the State of Idaho Trustee projects was also disposed in the CIA.

4.3.4.4 Operations and Maintenance

An O&M plan has not yet been developed for the CIA Closure. General O&M requirements for the completed CIA cover system are expected to include (CH2M HILL, 1997):

- Periodic inspection and occasional maintenance will be required for the general cover areas, drainage system and sludge ponds. This includes inspection and maintenance of settlement areas and maintenance of the cover system such as replacing soil, grass cover, or rock lost to erosion during severe storm events. Minor regrading would be required in areas where settlement causes water to pond over the cover.
- The drainage system will require periodic inspection and cleanout of catch basins and other structures.

Additional O&M requirements will be developed upon completion of the CIA Closure.

4.3.4.5 Assessment of Remedial Actions

A. Evaluate Remedy Performance

The CIA remedial action has been ongoing since 1995 when site removal materials began to be consolidated in the closure area. The capping of the CIA is planned to begin in 1999 and be completed in 2000. A complete assessment of the CIA remedial action can therefore not be conducted until the full remedy is complete. Performance observations from those remedial components that are complete are summarized below.

1. **Temporary Dust Control Measures**
   Dust suppression techniques are being used during construction. Once the cover is in place contaminants from the CIA will be prevented from migrating as dust.
2. **Institutional Controls**
   Fencing that is currently in place and enforced restrictions on access are preventing direct contact between humans and contaminants on the CIA. When the remedy is complete, the cover that will be placed will prevent direct contact as well as dust generation and reduce infiltration of water and metals migration.
3. **Collection of Upper Zone Groundwater in CIA Seep Area for Wetland Treatment**
   As noted above, the collection and treatment of the CIA seeps is being deferred until the effectiveness of the CIA Closure cap to minimize infiltration into the underlying tailings has been evaluated. As noted in Section 4.3.4.3, 10 to 15 years has been estimated for the CIA to drain on its own after capping. Based on this analysis, the next 5-year review will provide a mid-way point to evaluate whether the expected natural gravity drainage of the CIA is on track. Also, as noted in the

Smelterville Flats section, construction of the treatment wetlands is being deferred in order to evaluate if the increased focus on source removals will reduce and/or eliminate the need for passive wetland or other type of treatment.

4. **Repository for Consolidation of Non-PTM Materials from Site Removals**
The material consolidation portion of the CIA remedial action is essentially complete. An estimated 2 million cubic yards of tailings and mine waste material has been consolidated in the CIA Closure since 1995. This large quantity of material came from several on-site sources, and represents a significant increase in protectiveness than if these site materials were left in place. Once the CIA cover is in place and gravity drainage of water within the tailings is complete, the underlying materials will be prevented from further leaching into surface water and groundwater. Long-term monitoring of surface and groundwater in the vicinity of the removal areas, as discussed in the site-wide monitoring program (Section 4.2), should indicate the success of the waste consolidation activity at minimizing metals releases from this source.

5. **CIA Closure**
This remedial activity is in progress. The final capping should be completed by the end of the 2000 construction season. The effectiveness of this remedial activity to reduce contaminant migration will have to be evaluated from results of long-term monitoring of groundwater and surface water in the vicinity as well as water levels within the CIA fill. However, the geomembrane cover that will be installed will have a permeability several orders of magnitude lower than the ROD required permeability of $1X10^{-6}$ cm/sec.

B. New Information

The study of the collected water wetlands treatment system reported by the Bureau of Mines in 1998 concluded that the current state of technology of this process would not be effective under year-round site conditions for treatment of the metals. The treatment component for the site flows, including the CIA seeps, was therefore deferred by EPA and the State in favor of more extensive removals of source contaminants at the Site.

C. Identify Deficiencies

None were found.

D. Recommend Improvements

None at this time.

4.3.5 Page Pond Remedial Action – PRP-Implemented Remedial Action

4.3.5.1 Introduction and Background

This remedial action is being conducted by the PRP group of Hecla, Sunshine Mining, and ASARCO with oversight by the State of Idaho and EPA.

The Page Pond Area is located near the west end of the Bunker Hill site, and is bounded on the east by the community of Smelterville, on the south and west by Highway 10, and on the north by the Union Pacific Railroad Rights-of-Way (Figure 5). The Site comprises an area of approximately 170 acres, including approximately 70 acres of tailings repository and 100 acres of wetlands and riparian habitat.

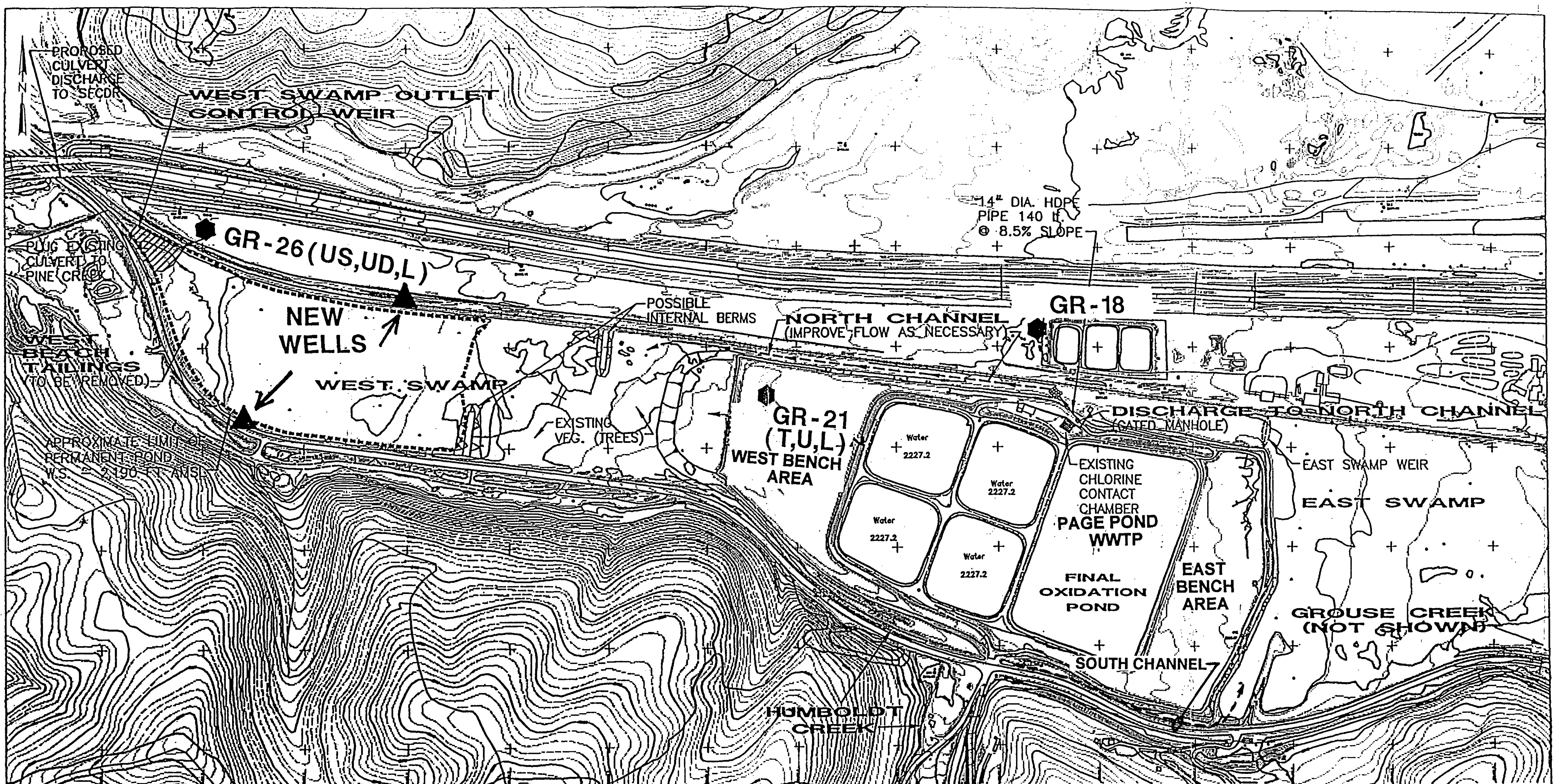
The Page Pond repository was used during the period between 1926 and 1968 as a deposition area for flotation tailings generated at the Page Mill in nearby Humboldt Gulch. Approximately 30 acres in the central portion of the inactive 70-acre tailings repository now serves as the site of the Page Pond Wastewater Treatment Plant (PPWWTP) which was constructed in 1974. The PPWWTP includes four aeration lagoons and a stabilization pond located atop the tailings impoundment. Treated effluent from the PPWWTP currently is conveyed to an outfall along the SFCDR approximately a half-mile upstream from the confluence of the river with Pine Creek.

The Page Pond repository is essentially surrounded by water that isolates it from public access except via the access road for the PPWWTP. Two natural wetlands, the East and West Swamps, are located to the east and west, respectively, of the tailings repository. The wetlands are connected along the north boundary of the repository by the North Channel, which conveys water from the East Swamp to the West Swamp. A smaller channel (the South Channel) is located along the southwest boundary of the repository and conveys localized runoff from the southeast corner of the repository eastward into the East Swamp. The water levels and surface areas of the swamps fluctuate seasonally with high water levels during periods of heavy rainfall and snowmelt in the spring and early summer and low water levels in the late summer and fall dry season.

In addition to the tailings in the repository, exposed tailings were present in the west end of the West Swamp in an area known as the West Beach, in localized areas in the North Channel, and in small quantities in other locations within the Page Pond area. Investigations of the East Swamp did not identify any significant quantities of tailings.

4.3.5.2 Review of ROD, ESDs and ROD Amendment

The 1992 ROD identified the tailings in the Page Pond area as a source of localized contamination of surface water and groundwater and of windblown dust. The east and west bench areas adjacent to the PPWWTP is also serving as repositories for soils removed from residential properties within the Bunker Hill site. Remedial actions specified in the ROD are summarized below in Table 4-7.



GR-21 EXISTING PAGE POND AREA MONITORING WELL

NEW PROPOSED MONITORING WELLS

0 250 500 750
SCALE IN FEET

SOURCE: MFG (1997)

FILE NAME: pm15fg04.dlv 20-APR-2000 07:41:39

CH2MHILL

Figure 5
Page Pond Site Map
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

Table 4-7
Page Pond Remedial Action

Remedial Actions	Remedial Action Objectives/Goals	Success Criteria	Document Source
[illegible]	[illegible]	[illegible]	[illegible]
Temporary dust control	Minimize exposure from fugitive dust	Meet ambient air criteria	ROD 9.2.4
Institutional controls	Prevent direct exposure to tailings and contaminated soil	Reduce the potential for accidental exposure	ROD 9.2.4
Maintenance of existing fencing	Prevent direct exposure to tailings and contaminated soil	Reduce the potential for unauthorized access	ROD 9.2.4
Divert and modify the channels of Humbolt and Grouse Creeks; consider the effect of modifications on habitat	Isolate the creeks from contact with tailings; minimize habitat destruction	Reduce releases from tailings into surface water; maintain habitats	ROD 9.2.4
Removal of exposed tailings from the West Page Swamp area and placement of this material on the Page Pond benches	Minimize exposure from fugitive dust; minimize releases to surface water and groundwater	Meet ambient air criteria; reduce releases from tailings to surface water and groundwater	ROD 9.2.4
Regrading, capping, and re-vegetation of the Page Pond tailings impoundment and dikes after emplacement of West Page Swamp tailings	Minimize exposure from fugitive dust; minimize releases to groundwater	Meet ambient air criteria; reduce releases from tailings to groundwater	ROD 9.2.4
Evaluation of wetlands associated with the Page Pond areas for water quality, habitat considerations, and bio-monitoring	Minimize habitat destruction	Maintain habitats	ROD 9.2.4
Enhancement of existing wetlands in West Page Swamp using hydraulic controls	Improve wetland vegetation and habitats	Enhance vegetation and habitats	ROD 9.2.4

4.3.5.3 Description of Remedial Actions Conducted at the Site

The remedial action at Page Pond is ongoing and is planned by the PRPs to extend over several years. The primary remedial action is planned to be implemented in four actions:

1. Removal of tailings from West Beach.

2. Removal of remaining localized accumulations of tailings and placement of clean soil barriers.

3. Modifications to the South Channel to increase flow capacity and efficiency from Humbolt Creek and to protect the toe of the south embankment; modifications to the North Channel to accommodate diversion of wastewater from the PPWWTP into the North Swamp; construction of the East Swamp and West Swamp outlet control structures, discharge channel, and culvert to the SFCDR.

4. Construction of internal berms within the West Swamp.

Of these four actions, only the removal of tailings from West Beach has been completed. The remaining actions are at the design stage.

The design for removal of tailings in the West Beach area of the West Swamp called for removal of tailings that were at an elevation higher than 2,187 feet (AMSL) to the extent technically practicable. The reference elevation was established 2 feet below the free-water surface that will be maintained in the West Swamp after construction of an outlet control structure. The removed tailings were to be deposited onto the west bench adjacent to the PPWWTP (the Page Pond repository).

Removal of approximately 40,000 cubic yards of West Beach tailings occurred in the winter of 1997-1998. The tailings were placed into the West Bench area of the Page Pond repository. About 50 percent of the tailings placed on the West Bench have been covered by soils from the Milo Creek flood control project. The tailings will eventually be completely covered by residential soils derived from the residential yard cleanup program of the Bunker Hill site. When the repository reaches final grade, the residential soils will be vegetated to provide a permanent cover for the tailings.

The current plan for Page Pond addresses other smaller accumulations of tailings that are present in portions of the North Channel and in isolated areas of the West Swamp. Some of these tailings will be completely removed in the same manner as the West Beach tailings. If it is not practicable to remove tailings remaining in the West Swamp to the reference elevation (2,187 ft. AMSL), then the remaining tailings will be left in place and covered with a minimum of 12 inches of clean soil. Some tailings will be left in place above the reference elevation without placement of a soil cover if the tailings are located in areas with well-established wetland vegetation and if the vegetation would be destroyed by removal activities.

The Remedial Action Plan for Page Pond includes improvements to the North and South Channels. Exposed tailings in the North Channel will be removed except where tailings will be below the reference elevation, where removal is not practicable or where tailings will be covered with embankment regrading materials. If exposed tailings remain above the reference elevation they will be covered with a barrier layer of clean soil. The North Channel will be trimmed to accommodate the design 100-year, 24-hour storm flow discharging from the East Swamp. A vegetative cover will be provided in the North Channel to provide erosion protection. A gated-concrete structure will be constructed in the North Channel to allow for diversion of wastewater from the PPWWTP into the North Channel. To control erosion, a grouted-riprap energy dissipation blanket will be placed over a non-woven geotextile on a swale-shaped subgrade at the pipe outfall from the wastewater diversion structure.

The west portion of the South Channel conveys discharge from Humbolt Gulch and runoff from an adjacent road and repository embankments to the West Swamp. The east portion of the South Channel conveys localized runoff from an adjacent roadway and repository embankments into the East Swamp. Since the east portion of the South Channel conveys only localized runoff, only minor construction such as channel trimming and grading are planned. The west portion of the South Channel will be trimmed to convey the design

100-year, 24-hour storm flow from Humbolt Creek. Riprap erosion protection will be placed along the toe of the repository embankment slope approximately 600 feet downstream from the confluence of Humbolt Creek with the South Channel.

Outlet control structures are planned for construction in the East and West Swamps. The outlet control structure for the East Swamp will be a weir across the eastern end of the North Channel. The weir will allow discharge of water down to elevation 2,203.5 feet and raise the discharge elevation by approximately 2 feet above the existing channel. The East Swamp will remain saturated for longer periods of time but could shrink in area or become dry during periods of extended dry weather. An outlet control weir will be located at the western edge of the West Swamp that will maintain a water level two feet above exposed tailings that remain in the West Beach. Since flows into the West Swamp will be supplemented by discharge from the PPWWTP, the West Swamp should remain saturated throughout the year. The outlet control weirs in each swamp will be constructed of compacted earth fill on firm native soil and will include a reinforced concrete sill and seepage barrier across the crest with an armored spillway on the crest and the downstream face. To control seepage through and beneath the West Swamp weir, a geosynthetic clay liner (GCL) will be used on the upstream face of the weir structure with an extension two feet below the invert. The West Swamp weir will also be provided with a flume to allow for measurement of flow rates and loading rates to the SFCDR.

The existing outflow from the West Swamp into Pine Creek will be plugged and a new discharge channel and culvert will be constructed to allow direct discharge into SFCDR. The channel from the new West Swamp weir will have a bottom width of 5 feet with 2:1 sideslopes, a minimum depth of 4.5 feet, a gradient of 0.005 ft./ft., and a length of approximately 420 feet. The new channel will be well vegetated to resist erosion. A new 72-inch culvert will be installed under the railroad embankment. The new culvert will be provided with headwalls and riprap blankets to protect the railroad embankment, improve flow into the culvert, and protect the channel from scour.

The existing plan calls for the construction of two internal berms in the eastern portion of the West Swamp to promote a water flow. The final number and design of the internal berms will be based on assessment of field conditions prior to construction. The internal berms will consist of clean granular fill placed over soft marsh sediments. Approximately 6 inches of growth medium will be placed on the berms and the berms will be planted with wetland/riparian vegetation.

Access to the Page Pond area will be restricted to authorized personnel. Most of the area will be surrounded by water that will restrict public access. The existing fencing and gates at the point of entry to the Site will be maintained and upgraded as necessary. Public access might be possible via the North Channel during dry periods. If this access route is found to be significant, new fencing with warning signs will be installed to restrict access. The need for and extent of new fencing will be determined in the field in consultation with EPA and State oversight representatives.

Interim measures will be taken at the Site while the cleanup action is implemented. These measures will include dewatering, stormwater management and sediment control, dust control, decontamination, and traffic control. Dewatering of the swamps will be allowed to occur naturally during the dry season to allow for minimum disturbance of wetland areas during construction. Dewatering might also include routing of drainage around areas during construction. Stormwater management and sediment control will include placement of temporary culverts to redirect flows and installation of silt fencing, straw bales or other sediment control facilities downstream of work areas. Upon completion of work natural flow paths will be restored and materials associated with sediment control will be disposed into the Page Pond repository.

Dust control will be accomplished using water trucks with hoses or spray bars. Heavy equipment, trucks, tools, and personnel will be decontaminated prior to leaving the Site in accordance with the governing Health and Safety Plan. Most traffic will be controlled onsite, however if it becomes necessary to move equipment along public roads the work will be done in accordance with Idaho Transportation Department rules and regulations.

The Bunker Hill Populated Areas Operable Unit Five Year Review Report discusses and evaluates potential recontamination issues associated with the PRPs residential soil disposal activities to the Page Repository. That document states that ICP soil samples obtained from the adjacent road and near the Page Pond area's gate were above cleanup levels of lead (up to 5,937 ppm) indicating that the PRPs current vehicle decontamination procedures may not be adequate. That document also recommended that additional decontamination and drainage control procedures be implemented at the Page Pond area to mitigate future vehicle tracking of contaminants.

4.3.5.4 Operations and Maintenance

Since construction of the majority of the Page Pond remedial action has not been completed, it is not possible to describe the final O&M plan. However, there are some proposed interim and post-closure O&M requirements that can be summarized. Objectives for interim O&M are to:

- Preserve the integrity and effectiveness of completed components of the remedy.
- Facilitate subsequent remedial actions.
- Limit erosion and transport of potentially contaminated materials from the component areas of the Site.
- Prepare the Site areas for winter shutdown periods between construction seasons.

Interim O&M activities will include installation and maintenance of interim stormwater management and sediment control facilities (ditches, silt fences, sediment traps, flumes, splash pads, etc.) and dust control.

Post-closure O&M activities will focus primarily on ensuring the integrity of the closure surfaces, drainage facilities, and site security provisions and on addressing monitoring of the performance and effectiveness of the remedy. Closure surfaces and site security provisions will be regularly inspected and repaired as necessary. Drainage facilities will be inspected to identify the onset of erosion, displacement of riprap, loss of vegetation, localized slope instability, or debris deposition and will be maintained and repaired as necessary.

Environmental monitoring will include sampling and testing of upstream and downstream surface water and effluent from the PPWWTP, sampling and testing of upgradient and downgradient groundwater, sampling and testing of soils and sediments in the West Swamp along surveyed transects, and monitoring of the establishment of wetland/riparian vegetation on the Site. Environmental monitoring will be reviewed every 5 years to evaluate the need for a continued long-term environmental monitoring program.

4.3.5.5 Assessment of Remedial Actions

A. Evaluate Remedy Performance

The only remedial action that has been completed at the Page Pond site is removal and relocation of tailings from the West Beach area of the West Swamp. The cleanup action was completed in accordance with the ROD. The only remaining work to be done on this cleanup action is the covering of the tailings with residential soil. This work will be completed as additional residential soils are generated from the ICP. Interim dust control measures will prevent air releases from uncovered West Beach tailings and interim access controls will prevent exposure.

The remaining remedial actions for Page Pond are expected to meet ROD requirements for minimizing releases to air, sediment, and soil and enhancing wetland vegetation. The increased water level in the East Swamp will prolong the seasonal high water level and enhance wetland vegetation. The increased water level in the West Swamp, in combination with flow diversion from the PPWWTP into the West Swamp, are expected to enhance wetland vegetation and prevent tailings remaining in the swamp from drying out and becoming fugitive dust. The establishment of wetland and riparian vegetation in combination with other erosion controls will minimize releases of tailings and their potential contamination of sediment. Placement of a vegetated residential soil cap over tailings deposited on the East and West Benches will prevent releases to soils and minimize potential exposure to waterfowl feeding in the area and to humans.

According to design analyses, releases of metals from tailings into surface water and groundwater will be minimized by placement of a vegetated residential soil cap over tailings on the east and west benches, maintenance of an elevated water level in the West Swamp, and the diversion of wastewater from the PPWWTP into the West Swamp. The vegetated residential soil cap on the benches is designed to increase evapotranspiration and reduce leachate generation and subsequent groundwater contamination from infiltration through the tailings. The increased water level and wastewater diversion into the West Swamp are designed to maintain a near neutral pH and create metal sulfides that will decrease the mobility of metals in tailings or sediments remaining in the West Swamp. Since these RAs have not been constructed, an evaluation of the effectiveness of these remedies cannot be completed at this time. Post-construction surface water and groundwater monitoring will be necessary to evaluate the effectiveness of these RAs on reducing releases to surface water and groundwater.

B. Discuss New Information

In 1996, EPA requested technical assistance through an interagency agreement from the U.S. Fish and Wildlife Service (USFWS) to characterize wildlife and vegetation in the Page Ponds area. This information was to document baseline biological conditions prior to remedial actions. A final report, prepared by USFWS in 1999, includes a waterfowl and breeding bird survey, identifies seasonal waterfowl use of the Page Ponds area including the treatment ponds and swamps, discusses waterfowl blood sample results, and characterizes the wetland and riparian vegetation in the swamps. The report concludes that: waterfowl numbers and diversity are most likely impacted by human activity adjacent to the treatment ponds and swamps; waterfowl captured in the East Swamp had elevated blood lead concentrations; and that possible sources of lead include tailings present in the ponds and swamps, possible airborne deposition, and storm water run-off entering the treatment ponds. These results will be used in the development of the biological monitoring program for the entire site, discussed in section 4.2 of this document, which is currently being planned.

C. Deficiencies Identified

A recent draft memorandum (CH2M HILL, 1999) has recommended improvements to the Page Pond baseline and routine groundwater and surface water monitoring programs. In particular, the draft memorandum indicates that four of seven existing monitoring wells plus two new wells should be included in the groundwater monitoring program (see Figure 5). The memorandum proposes the establishment of four new surface water monitoring stations. Proposed parameters for groundwater monitoring wells are lead, zinc, cadmium, arsenic, nitrate, phosphate, iron, manganese, ammonia, total organic carbon, pH, specific conductance, temperature, and static water level. Proposed surface water chemical monitoring parameters are the same as for groundwater except for the addition of total Kjeldahl nitrogen, dissolved organic carbon, total suspended solids, and dissolved oxygen. Flow rates at each surface-water monitoring station are also proposed in the memorandum. Additional details regarding proposed monitoring stations, frequencies, and parameters are provided in the draft memorandum.

The information in the draft memorandum suggests that there are possible deficiencies in the existing Page Pond monitoring program. The memorandum will need to be reviewed, revised, and finalized before the possible deficiencies can be verified and remedied.

D. Recommended Improvements

The Bunker Hill Populated Areas Operable Unit First Five Year Review Report discusses and evaluates the potential for inadequate decontamination procedures at the Page Ponds area that has resulted in vehicle tracking of contaminants to the Populated Areas of the Site. For further information and recommendations on this topic, please refer to Populated Areas First Five Year Review Report.

The memorandum regarding the Page Pond monitoring program (CH2M HILL, 1999) makes the following recommendations for further action and evaluation:

- Clarify regulatory considerations regarding beneficial wetland use, and discharge of sewage effluent to a water of the state.
- Develop a work plan that describes monitoring well installation, installation of surface water flow measurement devices, Quality Assurance and Quality Control (QA/QC) requirements and data quality objectives for water quality sampling and analysis, sampling protocols, database management responsibilities, and routine reporting requirements.
- Develop objective assessment statistical methods of analysis for determining the overall effectiveness of the wet closure remediation.
- Install additional groundwater monitoring wells, flow gauging devices, and staff gauges to complete the overall monitoring network; survey all new wells and staff gauges to establish horizontal and vertical control.
- Identify coordination opportunities with the administrators of other water quality monitoring programs to minimize collection of potentially redundant data.

As mentioned above, the memorandum will need to be reviewed, revised, and finalized before these recommendations can be approved and implemented.

Other than possible changes to the monitoring program, there are no current improvements that have been identified for the Page Pond remedial action. Long-term O&M of the remedial action should minimize metals releases to air, soil, and sediment. Future improvements might be necessary if post-construction groundwater and surface water monitoring determine that significant metals releases are continuing from the West Swamp or from the East and West Benches. If metals releases continue from the West Swamp, additional chemical adjustment of water within the swamp, or excavation and capping of additional tailings and sediments might be necessary. If continued leaching of metals from the benches is identified as a source of significant metals releases, installation of an impervious cap over the benches might be necessary to further reduce infiltration into the tailings.

4.3.6 Industrial Complex Remedial Action

4.3.6.1 Introduction and Background

The 1992 ROD defines the Industrial Complex as comprised of three main areas: the Lead Smelter, the Zinc Plant and the Mine Operations Area. This section focuses on the Lead Smelter, Zinc Plant, Phosphoric Acid Plant and the various areas used to store mine process materials (ores, concentrates, processed or partially processed material) associated with these facilities. The Mine Operations Area is discussed separately in Section 4.3.7.

The Industrial Complex typically contained the most highly contaminated areas of the Site with metal concentrations of mine processing material accumulations and soils well into the percentage range in many instances. Process material accumulation sites were present within and outside the various facilities. Risk assessments conducted during the Remedial Investigation (RI) phase resulted in a sub-set of site process materials that were designated at Principal Threat Materials (PTMs) based on their higher level of contamination. PTM action levels are:

- Antimony – 127,000 mg/kg
- Arsenic – 15,000 mg/kg
- Cadmium – 71,000 mg/kg
- Lead – 84,600 mg/kg
- Mercury – 33,000 mg/kg

Figure 6 shows the locations of the Lead Smelter, Zinc Plant, Phosphoric Acid Plant, and the Smelter Closure area. The Smelter Closure area is where the demolition debris from the Lead Smelter, Zinc Plant and Phosphoric Acid Plant and contaminated soil from various soil removal actions across the Site were disposed.

4.3.6 2 Review of ROD, ESDs, and ROD Amendment

Table 4-8 summarizes ROD, ESD and ROD Amendment requirements for the Industrial Complex remedial action.

Table 4-8
Industrial Complex Remedial Actions

ROD and ESD Requirements	Remedial Action Objective/Goal	Document
1. Temporary dust control on material accumulation sites	Control migration of windblown dust	ROD 9.2.1
2. Remove PCB transformers and PCB contaminated soils	Minimize direct contact risk	ROD 9.2.1
3. Repair or remove asbestos materials	Minimize direct contact risk	ROD 9.2.1
4. Institutional controls	Minimize direct contact risk	ROD 9.2.5
5a. Demolish Lead Smelter, Zinc Plant and Phosphoric Acid Plant structures in-place and cap to reduce infiltration.	Minimize direct contact risk	ROD 9.2.5
5b. Place contaminated materials and debris from the Zinc and Phosphoric Acid Plants in the Lead Smelter Closure and eliminate the closure planned for the Zinc Plant Area.	Reduce O&M costs by eliminating Zinc Plant closure.	ESD 12-95
5c. Maintain the Zinc Plant Concentrate Handling Building and Warehouse Building so that these structures can be turned over to the county for use as maintenance facilities.	Decontaminate structures to minimize direct contact risk	ESD 4-98
6. Demolish the Phosphoric Acid Plant warehouse	Minimize direct contact risk and imminent safety hazard	ESD 4-98
7. Relocate Boneyard materials under Smelter Cap	Minimize direct contact risk	ROD 9.2.5

Table 4-8
Industrial Complex Remedial Actions

ROD and ESD Requirements	Remedial Action Objective/Goal	Document
8. Consolidate under the Smelter Cap: - slag from west cell of CIA - material accumulations including former waste disposal or holding pond sediments within Smelter Complex - contaminated soil, tailings, and mine waste from removal actions conducted within the Site boundaries	Minimize direct contact risk	ROD 9.2.5
9. Close the Smelter Closure area with a cap having a hydraulic conductivity of 1 x 10-7 cm/sec or less and re-vegetate to minimize erosion	Minimize direct contact and infiltration and control erosion	ROD 9.2.5
10. Reprocess principal threat materials (PTM) and other recyclable materials to minimize the volume of materials under the closure cap	Material reuse	ROD 9.2.5
11. Dispose PTMs under the Lead Smelter Cap in a fully lined monocell (this amends ROD 9.2.5 which required chemical stabilization of PTMs)	Minimize direct contact risk and reduce potential for migration to groundwater	ROD Amdt 9-96
12. Demolish four (4) stacks in the Lead Smelter and Zinc Plant	Minimize direct contact risk	ESD 4-98

4.3.6.3 Description of Industrial Complex Remedial Action

The primary objective of the Industrial Complex remedial action was to consolidate contaminated soil and material accumulations from site removal actions and debris resulting from demolition of the Industrial Complex structures into an engineered closure with a low permeability cap. This section describes the various components of this remedial action.

A. Demolition of Industrial Complex Structures

Industrial Complex structures were demolished in two phases:

- **Demolition of Fire-Risk Structures (1995):** Wood structures, within the Lead Smelter and Zinc Plant, were demolished in the first phase of demolition in 1995. A total of 87 structures (about one-fourth of the structural area) were demolished (OHM, 1995). Prior to demolition, PCB-containing equipment was removed and disposed in accordance with applicable regulations, asbestos was removed, bagged and consolidated within a specific area of the Smelter Closure, and select equipment was salvaged for reuse or recycling. Lead Smelter structures were demolished in-place; Zinc Plant structures were demolished and than hauled to the Smelter Closure for burial. Slag was used as in-fill material with the wooden demolition debris to minimize void spaces and the potential for future settlement.

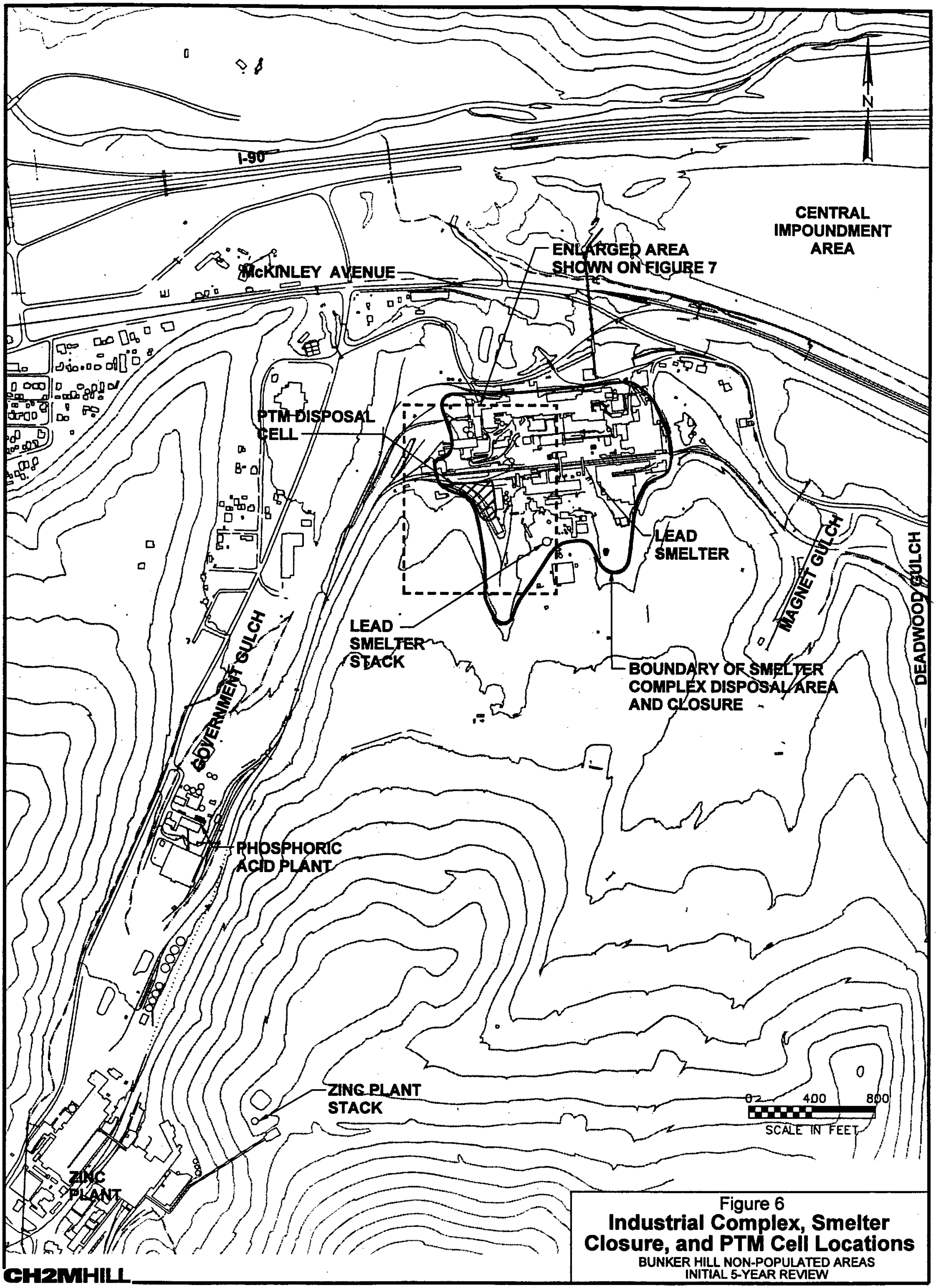


Figure 6
Industrial Complex, Smelter Closure, and PTM Cell Locations
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

CH2MHILL

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- **Demolition of Lead Smelter, Zinc Plant, and Phosphoric Acid Plant (1995 – 1997):** The remaining structures of the Lead Smelter, Phosphoric Acid and Zinc Plants were demolished between 1995 and 1997 (Morrison Knudsen, 1999). Similar to the procedures used for the wooden fire-risk structures, all PCB-containing equipment or other hazardous materials were removed prior to demolition. Asbestos abatement procedures were also similar with removed asbestos continuing to be disposed in the southwest corner of the Smelter

  Closure. Since the structures demolished in this phase were primarily steel and concrete, the resulting debris often needed to be reduced in size in order to be transported to the Smelter Closure as well as to minimize void spaces in the closure area. Slag, and eventually contaminated soil from various site removals, was used as in-fill for the debris.

- The Smelter and Zinc Plant stacks were dynamited on May 26, 1996 (Morrison Knudsen, 1999). The ROD initially did not require demolition of the two tallest stacks, but rather that, at a minimum, they be decontaminated. As noted in Table 4-8, the 1996 ROD Amendment revised the ROD to include demolition of these structures. The Lead Smelter stacks were felled into the closure area and buried with the rest of the demolition debris. The Zinc Plant stack was felled to the northeast behind a small ridge and buried in-place.

B. Consolidation of Debris and Other Contaminated Materials in Smelter Closure

The general intent of the ROD with respect to consolidation of contaminated materials was to place the most contaminated materials within the Smelter Closure (and Zinc Plant closure prior to its elimination in deference to a single debris closure area). For this reason, the ROD requirements for hydraulic conductivity of the Smelter Closure cap were one order of magnitude more protective (10-7 cm/sec versus 10-6 cm/sec) than the ROD requirements of the CIA Closure cap. (However, as noted in Section 4.3.4, CIA Closure, the inclusion of a geomembrane cover for the CIA increased the protectiveness of this closure to a level equivalent with the Smelter Closure). However, the philosophy of placing the most highly contaminated materials in the Smelter Closure continued, due in part to its greater distance from the SFCDR. Figure 6 shows the outline of the closure area. This area was designed to accommodate up to 420,000 cubic yards of material (CH2M HILL, April 1996, July 1996).

A brief description of the materials consolidated in the Smelter Closure follows:

- **Demolition Debris:** As noted above, debris from the Lead Smelter, Phosphoric Acid and Zinc Plants was consolidated in the Smelter Closure area. The debris was sized and placed to minimize void spaces. Slag and contaminated soil from removal actions was used to in-fill voids. The debris and slag/soil layers were typically compacted by the traffic of track dozers and haul equipment. The debris and soil were placed to the lines and grades of the final closure plan (CH2M HILL, April 1997).

Principal Threat Materials: PTM Mono-Cell: The 1996 ROD Amendment revised the 1992 ROD such that all PTMs except mercury were to be contained rather than stabilized. The ROD was amended because disposal of the PTMs in a mono-cell was judged to be equally protective as stabilization and up to 90 percent less costly. The requirement for stabilization of mercury contaminated material was not revised. The containment system required by the ROD Amendment is a fully-lined and sealed geomembrane mono-cell constructed within the boundary of the larger Smelter Closure (CH2M HILL, May 1996). Figure 6 shows the location of the PTM cell. Figures 7 and 8 provide more detailed plan and sectional views of the PTM cell. The PTM cell was designed and constructed in 1996 through 1997. The PTM cell was designed to have a maximum capacity of about 125,000 cubic yards of material. The geomembrane cover of the PTM cell could be adjusted as necessary to account for the wide volume range of expected PTMs. Stabilized mercury contaminated materials were also deposited in the PTM cell. The

PTM volume placed in the cell was not surveyed, however, based on general elevations of the top geomembrane cover, it is estimated that about 80,000 to 100,000 cubic yards of PTMs are contained in the PTM cell.

Boneyard Material: Figure 2 shows the general location of the Boneyard area. This area was used by the operators of the Smelter to dispose of process material accumulations and unused metal and wood debris from the facilities and processing equipment. Sampling conducted during the Remedial Design phase indicated that the majority of the contaminated Boneyard material was located within the upper 5 feet and that the soil concentrations were typically below PTM level. Based on the remedial design sampling, the majority of the Boneyard soil and larger wood and metal debris was deposited in the general Smelter Closure area.

- **Non-PTM Contaminated Soil:** Contaminated soil excavated as part of the source removal actions conducted throughout the Site that was below the specified PTM levels was disposed in either the CIA or the Smelter Closure. The decision of which closure would receive contaminated soil was primarily based on minimizing haul distances, accepting enough material at the Smelter Closure to meet final capping grades, and the closure schedule for the Smelter Closure final capping. Once the Smelter Closure final capping began in 1997, the CIA became the one contaminated soil consolidation area at the Site. The contaminated soil was placed within and on top of the demolition debris enabling the surface to be graded and contoured as necessary to accommodate the final closure grades necessary for capping and long-term surface water control.

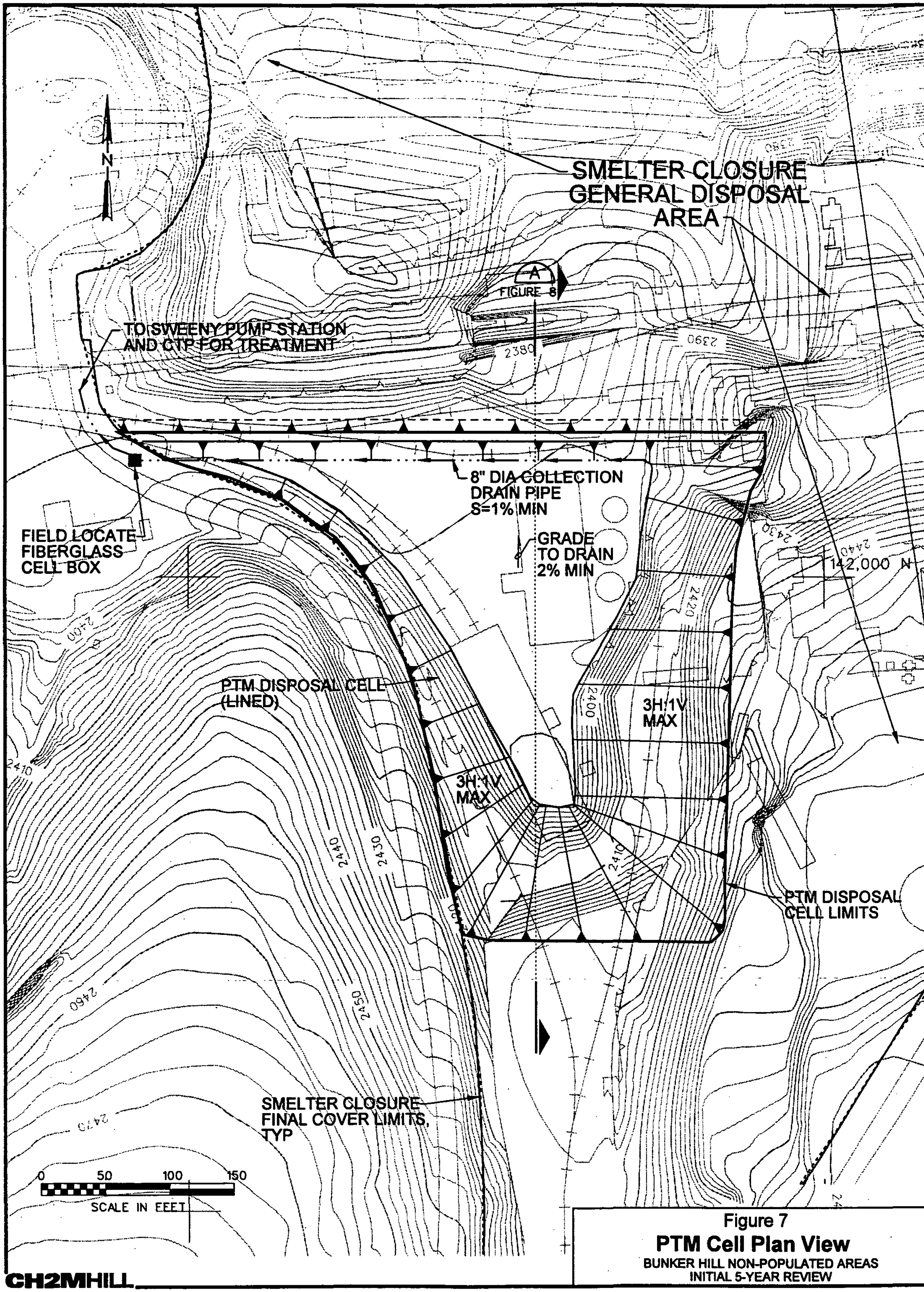
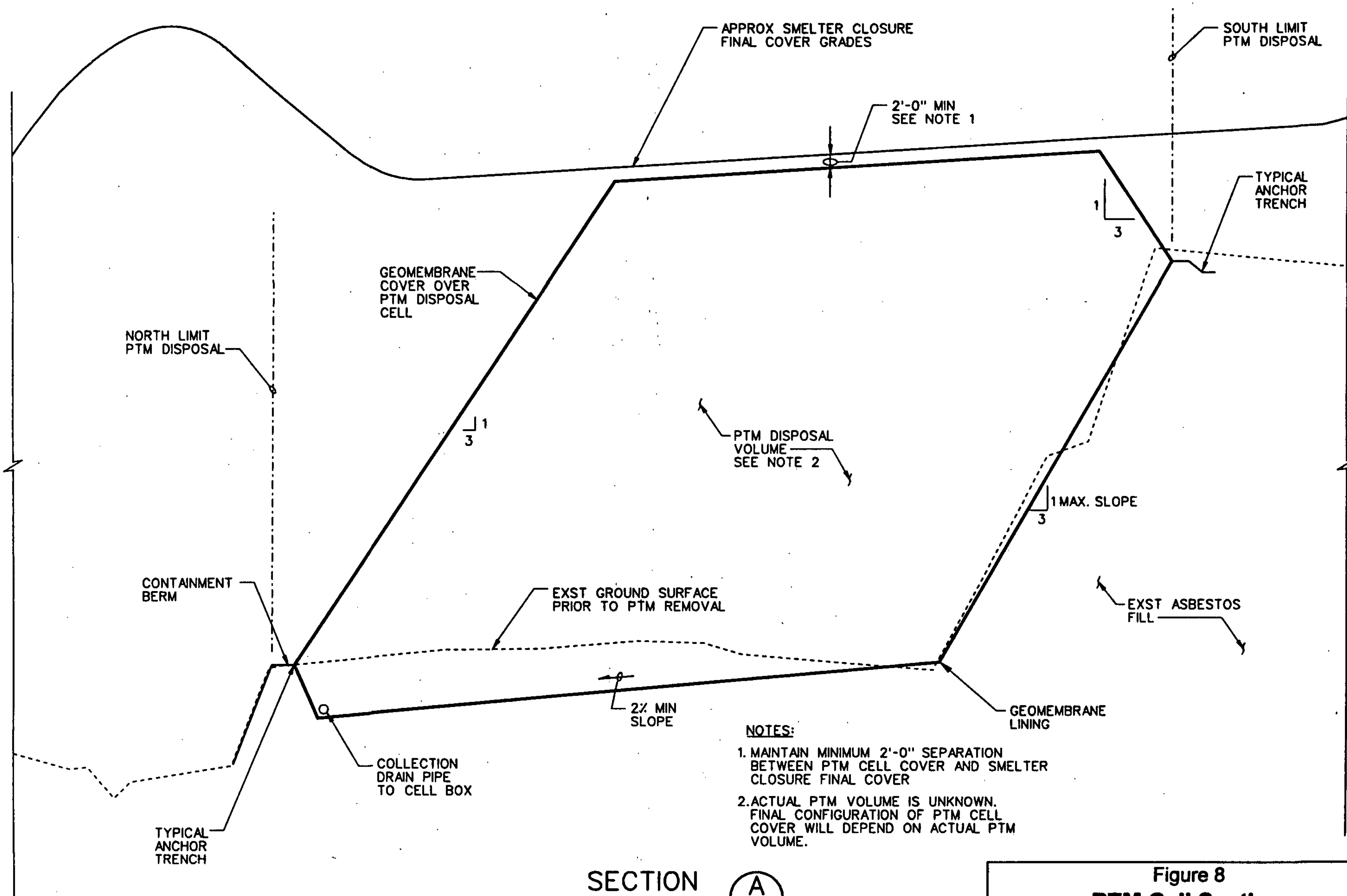


Figure 7
PTM Cell Plan View
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

CH2MHILL



NOTES:

1. MAINTAIN MINIMUM 2'-0" SEPARATION BETWEEN PTM CELL COVER AND SMELTER CLOSURE FINAL COVER
2. ACTUAL PTM VOLUME IS UNKNOWN. FINAL CONFIGURATION OF PTM CELL COVER WILL DEPEND ON ACTUAL PTM VOLUME.

SECTION (A)
5 HORIZ TO 1 VERT RATIO
FIGURE 7

Figure 8
PTM Cell Section
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

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- **Slag and A-1 Gypsum Pond Materials**: As noted above, slag was used as in-fill material in voids during placement of the demolition debris. The west cell of the CIA provided the slag source. When it was realized that the Smelter Closure could accommodate additional material, a portion of the A-1 Gypsum Pond (Figure 2) was also placed in the Smelter Closure because of the shorter haul distance in comparison to the CIA.

C. Capping the Smelter Closure

Once the contaminated soil was placed to its final design closure grades the Smelter Closure area was capped with a geomembrane liner and re-vegetated (CH2M HILL, June 1997). The closure was capped in two phases spanning two construction seasons, 1997 and 1998. Specific components of the Smelter Closure cap include:

- **Closure Configuration and Grading:** The 30-acre closure area footprint was defined by the existing perimeter roads encompassing the Smelter. The grading plan for the closure was developed to attain the containment volume necessary for the removal actions and as necessary for stability of the geomembrane cover layer. Slopes typically ranged between 3:1 to 4:1 and flatter. The top of the closure area was designed to be adjusted, as necessary to accommodate either greater or less volumes of consolidated materials.

- **Cover System:** The cover system consisted of 6 inches of slag placed on top of the final layer of contaminated material which served as a cushion for the overlying textured 60-mil HDPE geomembrane; a strip drain system to collect and convey infiltration to positive drainage outlets; and 12-inches of drain material (also slag) covered with 12 inches of growth media (a topsoil-like material). The growth media was then re-vegetated.

- **Surface Water Management:** Surface water management system consisted of stormwater ditches constructed around the perimeter of the closure, runoff control berms constructed on top of the cover, and culverts beneath roadways. The stormwater ditch system was designed and constructed to prevent run-on onto the closure cap and to collect stormwater and convey it to one of three adjacent creeks, (Government, Magnet, or Bunker Creek).

D. Re-vegetation of Disturbed Areas

The Smelter Closure cover and disturbed areas in the general vicinity were hydroseeded upon completion of the construction. Native seed mixes were used that had proven to be successful at the Bunker Hill site.

E. Borrow Area Development and Future ICP Landfill

To satisfy the "clean" fill (less than 100 mg/kg lead) requirements needed to complete several of the remediations, a borrow area was developed on a knoll located to the west of the Smelter (Figure 2) (CH2M HILL, April 1997). Generally, the upper foot of soil on this knoll did not meet the ICP clean fill requirements, and therefore was stripped and stockpiled to be used as growth media for the Smelter Closure vegetative layer. The borrow was used for general site fill in contaminated soil removal areas, for growth media development, and as grading fill needed for the

Smelter Closure. The borrow area will also be used as a clean soil source for backfill and capping when future remediations are conducted in the valley by the local community.

A future disposal area to be located within the confines of the Borrow Area is currently being designed by EPA and the State for local community use. The purpose of this repository will be to consolidate contaminated waste that may be generated by the community during remediations that is not being accepted by the local municipal landfills because of its suspected high contamination levels. This ICP landfill is anticipated to be constructed in 2001.

F. McKinley Avenue

The April 1998 ESD provides for EPA's participation with the local communities in the repair of McKinley Avenue once site remediations have been completed. During the remediation phase, the portion of McKinley Avenue that extends from the edge of Kellogg to Government Gulch road was closed to public traffic. This portion of the road received heavy truck traffic as part of the remediation. In light of this, EPA agreed to compensate the City of Kellogg for $542,530 for the remedial impacts. The City of Kellogg will be responsible for repairs, upgrades, or reconstruction of McKinley Avenue in the future as they see fit.

4.3.6.4 Operations and Maintenance Considerations

An O&M plan for the Smelter Closure has not yet been prepared. However, it is anticipated that O&M activities would include:

- Routine inspections of the closure cap vegetation for growth and signs of erosion.
- Inspection of ditches, runoff control berms and culverts for erosion and debris accumulation.
- General maintenance such as ditch and culvert cleaning, hydroseeding, and road maintenance.

4.3.6.5 Assessment of Remedial Action

A. Remedy Performance

The Industrial Complex remedy was constructed in accordance with its plans and specifications and the ROD requirements. It is performing adequately. In one location of the Smelter Closure cap, water overtopped a check dam in a drainage ditch and resulted in an area of erosion on the cap. This check dam, as well as all others, was removed and the cap was repaired. No further erosion has been noted on the cap, and the problem is not expected to occur again. Surface water drainage ditches located on the cap are performing as designed, and are conveying runoff off of the cap. In addition, water draining along the prior ground surface prior to the consolidation of demolition debris is being intercepted by the closure toe-drain and is conveyed to the CTP for treatment.

Routine and annual inspections and monitoring is necessary to verify ongoing performance (i.e., vegetative growth, erosion of cap, stability of surface water drainages, ongoing seepage monitoring, etc.).

B. New Information

EPA, the State, and the ICP continue to determine the regulatory and long-term management requirements of the future ICP Landfill. The design of this landfill will be influenced by the regulatory and operations requirements agreed to by the project stakeholders. As noted previously, this landfill is projected to be constructed during the year 2001.

C. Deficiencies Identified

No deficiencies have been identified. However as noted in Section 4.2 Site-Wide Monitoring, data continues to be gathered in the Smelter Closure Observational Approach monitoring program to evaluate whether down-gradient seepage collection is necessary for the Smelter Closure.

D. Recommended Improvements

None at this time.

4.3.7 Mine Operations and Boulevard Areas, Railroad Gulch Drainage

4.3.7.1 Introduction and Background

Historically, the Mine Operations Area (MOA) consisted of land and ore processing structures bounded on the north by the UPRR and the CTP and on the south by the cut-slope hillsides leading up to the Bunker Hill Mine (Figure 2). McKinley Avenue bisects the MOA in the east-west direction. The mining and ore-processing structures and facilities that were included in this remedial action of the MOA consisted of:

- the Powerhouse,
- the Concentrator Silo and conveyor system,
- the Concentrator Building and trestle system to the CIA,
- the mill settling pond, and
- two small ancillary office buildings west of the Concentrator Building.

For the purposes of this 5-year review document, the remediation of the Boulevard Area and improvements to the Railroad Gulch drainage system, both located to the west of the MOA on the southern side of McKinley Avenue, will also be addressed in this section. When ore processing was conducted at the Mine Operations facilities, the Boulevard Area was used as a staging area for concentrates prior to being loaded into rail cars, and transported to the Lead Smelter. Because the surface water flows from Railroad Gulch traverse across the eastern portion of the Boulevard Area, the drainage improvements associated with Railroad Gulch will also be addressed in this section.

4.3.7.2 Review of ROD, ESDs, and Rod Amendment

Table 4-9 summarizes requirements of the ROD and ROD Amendment for the Mine Operations and Boulevard Areas.

Table 4-9
Mine Operations and Boulevard Areas Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. **MOA:** Demolish or decontaminate structures consistent with intended future use	Prevent direct contact	ROD 9.2.5
2. **MOA:** Close or remove contaminated soil from the bottom of the mill settling pond	Prevent direct contact and minimize infiltration through contaminated material	ROD 9.2.5
3. **MOA and Boulevard:** Remove non-PTM contaminated soils with metal concentrations greater than 1000 mg/kg and dispose in the Smelter Closure	Prevent direct contact and minimize infiltration through contaminated media	ROD 9.2.5
4. **MOA:** Process, recycle or stabilize PTM accumulations	Material reuse, minimize material disposed and prevent direct contact	ROD 9.2.5
5. **Boulevard:** Dispose PTMs under the Smelter Closure cap in a fully lined monocell (this amends ROD 9.2.5 which required chemical stabilization of PTMs)	Prevent direct contact	ROD Amdt 9.2.5

Performance standards for the remedies include:

- Decontamination procedures for offsite salvage that are consistent with the proposed rule for Best Demonstrated Available Technology (BDAT) treatment technologies for contaminated debris (Federal Register, January 9, 1992).
- Management of PCB-containing equipment and other regulated wastes in accordance with the Toxic Substance Control Act (TSCA) and RCRA.
- Management of asbestos-containing materials in accordance with applicable regulations.
- Soil removal goal: Soil with lead concentration greater than 1,000 mg/kg.
- Placement of a minimum 6-inch thick clean fill cap over removal areas if surface concentrations are greater than 1,000 mg/kg lead in compliance with ICP requirements for industrial sites. Clean barrier fill is defined as having less than 100 mg/kg lead.

4.3.7.3 Description of Remedial Actions

A. Mine Operations Area

Up until the early 1980's, the facilities had been operational. Since being shut down, the structures became dilapidated from lack of maintenance as well as from piece-meal salvage operations by the owners of the MOA. With the bankruptcy of this owner/PRP, the MOA land and buildings were deeded to Shoshone County as payment for back-taxes. As new owners of the land and buildings, the County elected to demolish all structures.

The design of the MOA demolition and remediation was prepared in the summer of 1994. The MOA remediation included the following activities:

- Characterization and removal of hazardous materials located within buildings.
- Removal of concentrates and ores for reprocessing.
- Asbestos abatement and offsite disposal.
- Wash-down of buildings prior to demolition
- Demolition of buildings and disposal of debris on top of the CIA.
- Contaminated soil removal consistent with the ICP program.
- Site grading and placement of ICP barriers.
- Re-vegetation in designated areas.

EPA and the State of Idaho elected to use a site PRP, the Bunker Limited Partnership, and its EPA-controlled bankruptcy fund to contract and conduct the remediation. BLP in turn, hired Rust Environmental as their remediation contractor for the MOA. The MOA remediation was conducted in the summer of 1994 and completed in early 1995.

The work associated with the waste characterizations, removals, demolition, material disposal, and placement of protective barriers were all conducted according to remedial performance goals and plans and specifications.

B. Boulevard Area

The design of the Boulevard Area remediation was prepared in 1996. The remediation consisted of PTM and contaminated soil removals, replacement with clean soil and surface water control measures.

The depth of contaminated soil removals generally ranged between one to 6 feet across the Boulevard Area. PTMs were transported to the Smelter Closure and disposed in the geomembrane-lined PTM Cell; contaminated soil with lead concentrations less than PTM-level (84,600 mg/kg) were disposed in the general Smelter Closure area as in-fill of demolition debris and for closure grading. The final grading of the ICP barrier over the Boulevard promoted surface water flow to a roadside ditch constructed parallel to McKinley Avenue with culverts under McKinley Avenue that eventually conveyed Boulevard Area runoff to Bunker Creek.

C. Railroad Gulch Drainage System

As part of the Site remediation and not specifically cited in the ROD, the portion of the Railroad Gulch surface water channel that extends across the eastern end of the Boulevard area, crosses under McKinley Avenue, and then connects to Bunker Creek was reconstructed to increase flow capacity. This portion of the channel routinely flooded onto the Boulevard Area during high-flow spring run-off events and spread surface contamination throughout the area. The reconstructed channel was designed to accommodate a 10-year design storm. A conceptual design prepared by CH2M HILL was modified in the field by oversight personnel from CH2M HILL and IDEQ to fit site grading conditions (CH2M HILL, 1997). The channel reconstruction work was conducted using the BLP remediation fund. The channel was lined with riprap and culverts beneath McKinley Avenue were increased in size to handle the estimated spring run-off flows. Areas adjacent to the channel that were disturbed during construction were re-vegetated.

4.3.7.4 Operations and Maintenance Considerations

The O&M considerations for the MOA, Boulevard, and Railroad Gulch remedies will focus primarily on minimizing the possibility of surface recontamination, and therefore direct contact with underlying contaminated materials. This will be achieved by maintaining the integrity of the ICP barriers (either soil, rock, or vegetation) and by maintaining the final site grading and surface water control systems.

A final O&M plan has not yet been prepared for these areas, however, it is anticipated that O&M activities will include:

- Routine inspection of ICP cap surfaces for evidence of erosion or loss of vegetation.
- Routine inspection of drainage facilities (ditches, free-flowing sediment removal in culverts, ditch rock lining stable, etc.).
- Routine maintenance and repair as necessary.

In addition to the routine inspections, inspections after major storms and runoff events should also be conducted.

4.3.7.5 Assessment of Remedial Action

A. Remedy Performance

The MOA, Boulevard, and Railroad Gulch remedies are performing adequately in that they were remediated in accordance with design specifications and ROD requirements. The soil caps in the MOA and Boulevard areas remain intact and serve to prevent direct contact with underlying contaminated soils. In addition, the rock lined channel and sediment basin in Railroad Gulch remain fully operational. Routine inspections and monitoring are necessary to verify ongoing performance (i.e., such as ICP cap thickness, vegetative growth, and surface contamination levels, and stability of flow channel).

B. New Information

No new information exists concerning these remedies that would impact their performance.

C. Remedial Action Deficiencies

No deficiencies in the MOA, Boulevard, or Railroad Gulch drainage system improvements have been identified as part of this 5-year review.

D. Remedial Action Improvement Recommendations
No improvements to the MOA, Boulevard, or Railroad Gulch remedies are recommended as part of this 5-year review.

4.3.8 Central Treatment Plant

4.3.8.1 Introduction and Background

The Central Treatment Plant (CTP) was constructed in 1974 to treat metals-laden acid mine drainage from the Bunker Hill Mine using a lime precipitation process. The CTP is located at the base of the southeast corner of the CIA (Figure 2). The Bunker Hill mine water discharges from the portal of the Kellogg Tunnel, which is located about ¼ mile up Portal Gulch. When the ROD was written in 1992, the mine water was pumped out of submerged mine workings and flowed by gravity to the top of the CIA to an unlined holding pond prior to being conveyed to the CTP for treatment. Additional metals-contaminated water from other site sources (runoff from the Zinc Plant, Phosphoric Acid Plant, and the Lead Smelter) was pumped to the CTP for treatment beginning in the early 1980s. These additional site flows (often referred to as the 004 flows and the Sweeney Pump Station flows for the Zinc/Phos Plants and Lead Smelter, respectively) made up only a fraction of the water treated at the CTP in comparison with the Bunker Hill acid mine drainage.

4.3.8.2 Review of ROD, ESDs, and ROD Amendment

The ROD requires that acid mine drainage be conveyed to the CTP for pre-treatment prior to additional treatment in a constructed wetland system. As noted in the Smelterville Flats review (Section 4.3.3), the construction of the wetland treatment system has been deferred until the effectiveness of the large-scale tailings removal actions across the Site can be evaluated. Based on this decision, mine water and the minor amount of contaminated site waters continue to be treated to effluent discharge requirements established by the CTP's National Pollution Discharge Elimination Standard (NPDES) permit.

Currently, EPA and the State of Idaho are conducting investigations and evaluations that will result in a separate ROD to address acid mine drainage issues associated with the Bunker Hill Mine and long-term water treatment needs for the Site. Until this separate ROD is prepared and issued, the remedial action for the CTP will be one of continuing current procedures to treat the mine water to required discharge standards and disposal of treatment plant sludge in a designated unlined cell on top of the CIA (Section 4.3.4.1).

4.3.8.3 Description of Remedial Designs and Remedial Actions

To continue treatment of the Bunker Hill mine water and other contaminated site flows, EPA and the State decided that it was necessary to improve operational efficiency of the CTP, conduct more routine maintenance, and potentially upgrade some equipment. In addition, it was decided to cease the historic practice of placing mine water in unlined ponds on top of the CIA. As a result of these decisions by EPA and the State, the following remedial actions have been conducted at the CTP from 1995 to the present:

- **Construction of a Geomembrane-Lined Holding Pond**: Located on McKinley Avenue to the west of the CTP (Figures 2 and 4); pipelines from the Kellogg Tunnel and the 004/Sweeney Pump Station were constructed to discharge directly into the

Lined Pond (CH2M HILL, August 1994). The Lined Pond pump station and piping conveyed influent directly to the CTP. The purpose of the Lined Pond is to provide additional water storage capacity, to modulate the flow rate into the treatment plant, and to provide mixing of flows with various contaminant levels prior to treatment at the CTP. An additional benefit of the Lined Pond is that mine water no longer needs to be stored on top of the CIA.

- **Failure Modes and Effects Analysis of the CTP:** Conducted in December 1996 to identify immediate, near-term, and potential long-term maintenance needs, to evaluate the impact of various failure scenarios of the CTP, and to prioritize maintenance and equipment purchase needs (CH2M HILL, January 1997)
- **90 Percent Design of a New Mine Water Pond and Sludge Holding Facility:** In the spring of 1997, EPA's design contractor prepared 90 percent complete construction plans and specifications for a new lined pond and sludge facility that was to be constructed on top of the CIA (CH2M HILL, March 1997). At the State's request, the construction of this mine water storage and sludge facility was deferred pending the results of a separate RI being conducted by EPA of the Bunker Hill Mine's acid mine drainage.
- **High Density Sludge Pilot Study:** Conducted between March and July 1997 to optimize treatment efficiency and as a means to decrease the sludge volume that would require disposal (CH2M HILL, December 1997). This pilot study indicated that the HDS process is a more efficient process but that additional equipment and capital investment is necessary to operate in the HDS treatment mode.
- **Direct Discharge Line from the Mine to the CTP:** Constructed by the Bunker Hill Mine owner in 1997, this direct pipeline to the CTP would enable mine water to bypass the Lined Pond if desired.
- **Installation of New Mine Water Discharge Line to the CTP:** Constructed in May 1999, this new pipeline was necessary to replace the original line that failed to carry the necessary volume of mine water flows.
- **Miscellaneous O&M Activities:**
  - Rebuilding the thickener drive-head
  - Periodic raising of the sludge impoundment berms
  - Closing the east sludge cell
- **ICP Barriers on the CTP Property:** A minimum 6-inch ICP barrier was placed on the CTP property (approximately 12.4 acres) in the fall of 1997.

4.3.8.4 Operations and Maintenance Considerations

The responsibility for operating and maintaining the CTP has rested with three different organizations since the ROD was signed in 1992; two different site PRPs (Gulf/Pintlar) and the Bunker Limited Partnership, and from 1996 to the present, by the USACE and their contractors.

O&M manuals for the CTP and the Lined Pond were revised and upgraded to optimize the plant's efficiency in 1997. As mentioned above, EPA is currently preparing to write a separate ROD that will address the long-term management aspects of the Bunker Hill Mine acid mine drainage and the CTP. Until that time, O&M activities are expected to continue at their present level.

4.3.8.5 Assessment of Remedial Action

A. Remedy Performance

Performance of the CTP remedy is measured daily by monitoring the effluent standards prior to discharge to Bunker Creek. The treatment plant operators are required by the NPDES permit to take daily samples and submit monthly discharge monitoring reports. The CTP continues to meet its current discharge standards with only minor excursions.

The goal of limiting direct contact with contaminants in soils surrounding the CTP has been achieved by placing 6-inch ICP barriers on the CTP property.

B. New Information

As noted above, a remedial investigation and feasibility study (RI/FS) are currently being conducted by EPA and the State of Idaho to evaluate options for the long-term management of acid mine drainage from the Bunker Hill mine. The investigation includes options for reducing the metals content and amount of mine drainage being produced by diverting surface water from the most acid-laden portions of the mine, upgrades to the current treatment plant, and options for continued sludge disposal. The unlined sludge disposal cell on top of the CIA is estimated to have only a few years of remaining capacity. A treatability study is also being conducted to evaluate the potential for meeting the CTP waste load allocations for lead, cadmium and zinc that have been issued in a draft Total Maximum Daily Limit (TMDL) for the South Fork of the Coeur d'Alene River.

A draft technical support document for establishing TMDL for dissolved cadmium, dissolved lead, and dissolved zinc in surface waters of the Coeur d'Alene Basin was jointly issued by EPA and the State of Idaho in April 1999. The proposed TMDL establishes loading capacities, waste load allocations, load allocation, background conditions, and a margin of safety in accordance with Federal regulations. Until its final approval by EPA, the Coeur d'Alene TMDL is considered "to be considered" information.

When this draft technical support document is finalized, the TMDL will be evaluated to determine if it meets NCP standard for adopting as an ARAR that are issues after ROD signature. Based on the draft technical support document, EPA expects that the TMDL will be identified as an ARAR for the Site. Compliance with the potential new TMDLs would likely require upgrades to the CTP and changes in operational approaches to treat the water.

C. Identify Deficiencies

No deficiencies were noted.

D. Recommended Improvements

1. The CTP is functioning adequately and in accordance with its treatment and discharge requirements. However, the plant requires a significant amount of routine maintenance and upkeep based on the plant's age (constructed in 1974). The EPA RI/FS being conducted for the Bunker Hill acid mine drainage is also addressing options associated with the upgrade of the CTP. The RI/FS is expected to identify additional recommendations for improving the operational efficiency of the CTP as well as reducing routine O&M costs.

2. The Lined Pond was designed to have capacity for about 1.5 feet of sediment at the bottom of the pond prior to it needing to be cleaned out. At the time of this 5-year review, the sediment in the pond needs to being removed. It is recommended that this cleaning occur during the spring/summer of 2000.

3. Storage capacity of sludge generated from treatment of water at the CTP is limited to less that 6 years. The Bunker Hill Mine RI/FS is also evaluating sludge disposal options. It is recommended to closely monitor the available sludge capacity remaining in the current disposal pond to ensure that adequate capacity remains until a long-term storage solution can be put in place.

4.3.9 Bunker Creek

4.3.9.1 Introduction and Background

At the time of ROD preparation, Bunker Creek consisted of a man-made conveyance ditch that originated near the CTP and flowed west along the base of the CIA. It then angled north at the western end of the CIA before flowing into a culvert system beneath I-90 to its discharge point in the SFCDR (Figure 2).

Prior to its remediation in 1996 and 1997, Bunker Creek received flow from several sources, including storm drainage from a portion of western Kellogg, effluent discharge from the CTP, and surface water from Railroad, Deadwood and Magnet Gulches.

Aerial photography taken in the later 1930's indicates that in the Bunker Creek location, a natural drainage/wetland existed prior to the construction of the CIA. Historical records indicate that uncontrolled dumping of coarse tailings, fine-grained tailings (slimes), and mine waste rock occurred in the Bunker Creek corridor, similar to much of the Silver Valley. Sampling and testing conducted during the RI indicated that the corridor was moderately to highly contaminated. Lack of maintenance, sediment deposition from the tributary gulches, and flow through underlying contaminated tailings all contributed to poor hydraulic performance and water quality degradation in the Bunker Creek corridor.

4.3.9.2 Review of ROD Requirements

ROD requirements for Bunker Creek are summarized in Table 4-10.

Table 4-10
Bunker Creek Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. Channelize and line Bunker Creek	Minimize infiltration through contaminated material and minimize releases to surface water	ROD 9.4
2. Treat base flows of Bunker Creek if water exceeds Federal Water Quality Criteria	Minimize releases to surface water	ROD 9.2.5
3. Remove non-PTM contaminated soils with lead concentrations greater than 1000 mg/kg and dispose in the Smelter Closure	Prevent direct contact and minimize infiltration through contaminated media	ROD 9.2.5

The 1992 Non-Populated Areas ROD specifies that Bunker Creek is to be channelized and lined. The ROD does not specify the type of lining (i.e., compacted soil, geomembrane, concrete, etc.) nor the degree of liner permeability that was intended. In 1995, TerraGraphics, the State of Idaho's consultant, conducted the subsurface exploration to determine the nature and extent of contamination in the Bunker Creek corridor as well as the general geotechnical qualities of the underlying materials. Based on the subsurface exploration and the planned elevation of the creek bottom, it was decided by EPA and the State that the in-place soil had an existing permeability sufficiently low enough that a separate constructed lining for Bunker Creek was not necessary (i.e., the in-place low permeability soils would perform as a liner). This decision to use the in-place soils as a natural liner for Bunker Creek was not considered a change to the intent of the remedy, and therefore, it was determined by EPA that an ESD was not necessary to document this design change.

The 1992 ROD also states that the Bunker Creek base flows are to be treated in the collected water wetland should sampling indicate exceedances of Federal Water Quality Criteria (FWQC).

At the time the ROD was prepared, the collected water wetlands were to be constructed in the Smelterville Flats area. The April 1998 ESD clarifies that because of a greater focus on source removals in Smelterville Flats and in other areas of the Site, the wetlands are not planned for immediate construction in the Flats. The ESD defers construction of the wetlands in order to provide time to evaluate if the more significant source removals would result in the wetlands being unnecessary to reach surface water and groundwater goals. With respect to the quality of Bunker Creek flows, surface water quality measurements are being taken as part of site-wide monitoring (Section 4.2.1) and flows currently do not meet FWQC. If monitoring data over time indicates that the large-scale source removals have not resulted in the Bunker Creek water quality improving to required levels, additional remedial actions such as treatment of Bunker Creek base flows may be necessary.

4.3.9.3 Description of Remedial Action

The Bunker Creek remedial action was conducted between September 1996 and November 1997. The major elements of the Bunker Creek remedial action included:

- Reconstructing approximately 7,600 linear feet of the creek channel, including a low flow channel and floodplain. The stream reach reconstructed extends from I-90 to just downstream of the temporary road between the CTP and the Christopherson Assay Lab. The low flow stream channel was rocked for erosion protection; the floodplain was seeded.
- Removing flotation slimes exposed at the surface of channel excavations to a depth of 2 feet below the slimes and backfilling to stream grade with clean compacted backfill material meeting the ICP requirements of less than 100 parts per million lead.
- Disposing excavated slimes on the CIA.
- Incorporating non-contaminated excavated material into the grading of the adjacent floodplain.
- Installing culverts and riprap headwalls for three road crossings to maintain necessary site access over Bunker Creek.
- Placing minimum 6-inch ICP barriers at the surface of all disturbed areas in the Bunker Creek corridor. As of the time of this initial 5-year review, only the southern side of the Bunker Creek corridor from about the Lined Pond east to the CTP has received an ICP barrier. The northern portion of the Bunker Creek corridor will receive its ICP barrier in 2000 as part of the CIA Closure activities. The area to the west of the CIA where Bunker Creek flows in a northerly direction will require capping at the completion of the CIA remedial action (completion planned for 2000). The CIA construction traffic through this western portion of the Bunker Creek corridor prevents capping at this time.

4.3.9.4 Operations and Maintenance Considerations

The O&M considerations for the Bunker Creek corridor will focus primarily on minimizing direct contact with underlying potentially contaminated materials and maintaining the hydraulic capacity of the creek channel such that surface water flow is unimpeded into the SFCDR. Maintaining hydraulic capacity of the channel will minimize the quantity of surface water that may leak down through the natural low permeability layer beneath the channel.

An O&M plan has not yet been prepared for this area. However, it is anticipated that O&M activities would include:

- Routine inspection of ICP cap surfaces for evidence of erosion or loss of vegetation.
- Routine inspection of Bunker Creek channel (free flowing, sediment removal in channel/culverts, channel rock lining and riprap headwalls stable, etc.).
- Routine maintenance and repair as necessary.

In addition to the routine inspections, inspections after major storms and runoff events should also be conducted.

4.3.9.5 Assessment of Remedial Action

A. Remedy Performance

Remedy performance for the Bunker Creek corridor is judged primarily on inspections that focus on the integrity of the ICP barriers, on maintaining the hydraulic capacity of the channel, and on monitoring water quality. To date, assessment of the remedy has focused on water quality.

Water quality is monitored quarterly as part of the site-wide monitoring program (Section 4.2.1). The water quality of Bunker Creek is significantly influenced by the water on the various creeks and discharges that drain into it (Railroad, Deadwood, and Magnet Creeks; CTP discharge; surface water runoff from the perimeter ditches of the Smelter Closure). Bunker Creek water quality currently does not meet FWQC, however, this is expected considering that the Bunker Creek remedy and the remedies of all the other site tributaries that flow into Bunker Creek have only been in place for one to 2 years. Bunker Creek and the site tributaries are continuing to stabilize, and less sediment moves downstream now than did prior to creek remediations. It will be necessary to continue monitoring water quality of Bunker Creek and its tributaries in order to gather appropriate data to determine if any further remedial actions are necessary to meet the water quality requirements for Bunker Creek.

B. New Information

None noted.

C. Identify Deficiencies

Water quality of Bunker Creek does not currently meet FWQC. However, it is expected that its water quality will improve over time as the water quality of the various drainage that flow into Bunker Creek improves as a result of their individual remedial actions.

D. Recommended Improvements

None noted.

4.3.10 Union Pacific Railroad Rights-of-Way – PRP-Implemented Remedial Action

4.3.10.1 Introduction and Background

This remedial action is being conducted by the Union Pacific Railroad with oversight by the State of Idaho and EPA.

Approximately 7.75 miles of UPRR ROW run east/west through the Bunker Hill site. The location of the UPRR within the Site is shown on Figure 2. The width of the UPRR ranges from 60 to 200 feet. The Wallace Branch of the UPRR, including the portion that runs through the Bunker Hill site, has been taken out of service and is no longer used to transport materials. The right-of-way of the railroad is being maintained for recreational uses only.

The rail line was constructed in the late 1800s and transported mining products to and from the Coeur d'Alene River Valley. Mine tailings and waste rock were prevalent in the valley from the mining activities that date to the last 20 years of the 19th century. In portions of the UPRR, these lead-bearing materials were used in the construction of the original rail bed. Lead-bearing mine tailings and concentrates may also have been deposited on portions of the UPRR from historical flood deposition as well as from occasional spillage from the rail cars. On the basis of results of sampling in the Bunker Hill site, the UPRR was not identified as an active contributor of lead to the environment (AGI, 1991). Accumulations of lead-bearing materials were essentially confined to the ballast area beneath the track.

4.3.10.2Review of ROD, ESDs and ROD Amendment

The majority of the UPRR is located in the non-populated area of the Site; however, portions of the UPRR are adjacent to populated areas such as commercial and residential areas of Smelterville and Kellogg. The portions of the UPRR that are adjacent to the Populated Areas of the Site are further discussed and evaluated in the Bunker Hill Populated Areas Operable Unit First Five Year Report. Since the portions of the UPRR are located in both areas, the ROD specified that remedial action for rights-of-way in residential areas must meet the requirements of the Residential Soils ROD. The Non-Populated Areas ROD states that ROWs in the Non-Populated Areas of the Site will be capped in most instances (ROD, 9.2.6).

Remedial actions specified in the ROD are summarized below in Table 4-11. For reasons cited above, requirements from both the Non-Populated Areas ROD and the Residential Soils ROD are included in Table 4-11.

The Residential Soils ROD sets a threshold level for lead concentrations in soils of 1,000 mg/kg. Criteria for removal and replacement of soil according to the Residential Soils ROD is as follows:

- If the 0- to 1-inch or 1- to 6-inch-depth intervals exceed the threshold level, 6 inches of contaminated material will be excavated and replaced. In addition, if the 6- to 12-inch interval exceeds the threshold level, another 6 inches (total of 12 inches) will be removed and replaced. If the 6- to 12-inch interval does not exceed the threshold level, the property will have a 6-inch excavation and replacement.
- In the case where the 6- to 12-inch-depth interval exceeds the threshold level but the 0- to 1-inch and 1- to 6-inch intervals do not, 12 inches of material will be excavated and replaced.
- If the 0- to 1-inch and the 1- to 6-inch and the 6- to 12-inch intervals do not exceed the threshold level, the property will not be remediated.

Table 4-11
UPRR Remedial Actions

Remedial Actions	Remedial Action Objectives/Goals	Success Criteria	Document Source
UPRR in Populated and Non-Populated Areas			
Temporary dust control	Minimize lead exposure from fugitive dust	Meet ambient air criteria	ROD 9.2.6
Enforce existing controls on access	Prevent direct exposure to contaminated soil	Reduce the potential for unauthorized access	ROD 9.2.6
Maintain existing fencing	Prevent direct exposure to contaminated soil	Reduce the potential for unauthorized access	ROD 9.2.6
Institutional controls	Prevent direct exposure to contaminated soil	Reduce the potential for accidental exposure	ROD 9.2.6
Permanent dust control through containment, "hot spot" removal, soil/rock barriers, and re-vegetation	Minimize lead exposure from fugitive dust	Meet ambient air criteria	ROD 9.2.6
Additional Action for UPRR Adjacent to Residential Areas			
Treat consistent with the remedial action selected in the Residential Soils ROD	Minimize lead exposure from fugitive dust; prevent direct exposure to contaminated soil	Meet ambient air criteria; reduce the potential for accidental exposure	ROD 9.2.6

The *1997 Annual Remedial Action Implementation Plan for Remedial Actions Along the Union Pacific Railroad Rights-of-Way* (MFG, April 1997) (the 1997 Implementation Plan) states that the ROD requires removal from the UPRR of process material having measured lead concentrations exceeding levels typically associated with mine tailings or waste rock. In accordance with this requirement, concentrate, ballast, and soils with lead concentrations exceeding 30,000 mg/kg and not attributable to mine tailings or waste rock were to be excavated from the UPRR and disposed. In addition, all portions of the UPRR with lead concentrations in excess of 1,000 mg/kg in the top 12 inches (or 6 inches, depending on location) of ballast or soil were to receive either barrier placement, removal, replacement (if necessary, to maintain drainage), re-vegetation, and/or access control, dependent on geographic location and current land use.

4.3.10.3 Description of Remedial Actions Conducted at the Site

Work first began on the UPRR in 1995. Under an agreement with EPA and the State of Idaho, some portions of the UPRR would be remediated by EPA and the State in exchange for use of the UPRR for construction of a haul road to transport mine tailings from Smelterville Flats to the CIA. Other portions of the right-of-way would be remediated by UPRR as part of their Consent Decree with EPA. Remediation of the UPRR right-of-way extended from 1995 through 1999. Yearly activities included the following:

1995
Areas of concentrate ("hot spots") were identified and removed, transported to the Smelter Complex, and placed in storage for eventual disposal in the Smelter Closure area.

The UPRR was subdivided into 250-foot segments to establish a basis for sampling. Sampling and analysis was conducted to determine where and to what depth excavation along the UPRR would occur (soils near the Concentrator Building of the Mine Operations Area were to be removed to a depth of 18 inches).

Dust control was performed in 1995 and in each subsequent year until remediation was completed in 1997.

1996
Rails, ties, and other track material were removed prior to ballast and soil excavation; decontaminated materials were shipped offsite for reuse; contaminated or unusable materials were disposed in the CIA.

After rail and tie removal, excavation occurred in all or portions of the UPRR from Kellogg on the east side of the Bunker Hill site to the west where the UPRR goes beneath I-90 near the Pinehurst Narrows; verification sampling proceeded concurrently with excavation activities.

Excavated materials from most areas were disposed in the CIA; potential PTM materials from the concentrator and other areas were stockpiled and sampled and those identified as PTM materials were transported from the CIA to the PTM cell at the Lead Smelter site.

Clean soil barriers (less than 100 mg/kg lead) were placed along UPRR adjacent to or near residential areas in Smelterville.

A portion of a residential yard in Smelterville and a landscaped area in front of the Kellogg Lumber commercial facility in Kellogg were remediated since they were located on the UPRR.

1997
Railroad ties remaining from the 1996 removal were sorted and either decontaminated for reuse or disposed in the CIA.

Excavation, disposal, verification sampling, and barrier installation continued along the remaining portions of the UPRR that needed remediation except those to be remediated by EPA and the State of Idaho.

1998 – 1999
Verification sampling was completed on areas remediated by UPRR; cover material was added to deficient areas.

The majority of work was completed by EPA and the State of Idaho on the portion of the UPRR that was used as a haul road for the CIA.

There are several types of areas along the UPRR that were determined to be no action areas. No action areas were defined as those areas of the UPRR with total lead levels that exceeded the action level of 1,000 mg/kg, but where physical conditions precluded remediation. The no action areas included river embankments, hillside areas, paved areas, submerged portions of Page Swamp, and densely vegetated areas. River embankments and paved areas were no action areas because they already had effective barriers of riprap and pavement, respectively. Hillside areas were no action areas because they either consisted of rock outcrops or were well vegetated. Excavation or barrier installation on a rock outcrop could have resulted in slope instability. Excavation or barrier installation on vegetated hillsides or other densely vegetated areas was not recommended because of the difficulty in re-establishing the vegetation.

Approximately 7,000 feet of the UPRR is adjacent to the north boundary of Page Pond. The toe of the slope of the south portion of the UPRR in this area is either submerged or heavily vegetated. The submerged areas of this embankment were determined to be no action areas because they will be addressed as part of the Page Pond remedial action.

According to the *Letter Report for Submittal of Sampling Results for Union Pacific Area 5-Yr. Review Rights-of-Way Sampling at the Bunker Hill Superfund Site* (MFG, June 1999) (the 1999 Sampling Report), some areas of the UPRR still remain to be remediated by EPA and the State of Idaho. Verification sampling needs to be completed by EPA and the State of Idaho along the portions of the UPRR that were used for the CIA haul road. Crossings of the UPRR that allow access to the CIA are located between Smelterville and Government Gulch Road, east of Government Gulch Road adjacent to McKinley Avenue, and near the west side of the Concentrator area. These crossings will most likely become permanent. The crossing between Smelterville and Government Gulch Road and the crossing near the west side of the Concentrator area have been paved. The crossing between east of Government Gulch Road adjacent to McKinley Avenue is planned for paving. This work that remains to be completed by EPA and the State of Idaho on areas of the UPRR is scheduled for completion in 2000.

Although not required as part of the UPRR remedial action, it should be noted that the portion of the UPRR from Smelterville through Kellogg to Elizabeth Park has been paved as part of trail construction. Paving of remaining areas of the UPRR within the Bunker Hill site is currently under consideration.

Detailed mapping of the work along specific segments of the UPRR, of the no action areas, and of the areas remediated by EPA and the State of Idaho is provided in the 1999 Sampling Report.

4.3.10.4 Operations and Maintenance

Proposed O&M activities for the UPRR are presented in the *Bunker Hill Superfund Site Union Pacific Area Remedial Action Work Plan* (MFG, March 1995) (the 1995 Work Plan). Annual inspections of areas capped with a rock barrier and areas capped with a re-vegetated soil barrier will be conducted by Union Pacific Railroad representatives until ownership of the UPRR is transferred to other parties. If areas of rock barriers are found to be disturbed or eroded, they will be repaired using additional rock or other barrier material depending on site specific needs. Re-vegetated soil barriers will be similarly repaired if they are found to be disturbed or eroded. If re-vegetated areas are found to be inadequately re-vegetated within 3 years of seeding, they will be reseeded by Union Pacific representatives and inspected until re-vegetation is completed. Additional O&M activities will include preparation of a Post Closure O&M Plan with a UPRR annual inspection procedure that includes a checklist of key inspection criteria. An O&M plan for some portions of the UPRR outside of the Bunker Hill site has been prepared, and the general contents of this plan are similar to the plan proposed for portions of the UPRR within the Site boundary.

4.3.10.5 Assessment of Remedial Actions

A. Remedy Performance

According to the maps presented in the 1999 Sampling Report, remediated areas of the UPRR have been remediated in accordance with the requirements of the ROD, the 1995 Work Plan, and the 1997 Implementation Plan. In 1999, data was collected from 32 sampling locations along the UPRR. The analytical results of sampling the UPRR presented in the 1999 Sampling Report indicate that none of the areas sampled exceeded the 1,000-mg/kg threshold concentration for lead. Two samples had elevated lead concentrations (Table 4-12), however these concentrations were well below the 1,000-mg/kg threshold concentration.

Barrier depths were also determined at each sampling location. The majority of barrier depths met or exceeded the prescribed barrier thickness, however barrier thickness deficiencies were identified at seven locations (Table 4-13).

In general the remedy is meeting performance standards and cleanup goals since none of the sampled areas exceeded the 1,000-mg/kg threshold lead concentration. However, seven of the areas sampled for barrier thickness does not meet prescribed barrier thickness requirements.

Table 4-12
Samples with Highest Lead Concentrations
(Concentrations in mg/kg)

Sample ID	Segment ID	0 – 1 Inch Deep	1 – 6 Inches Deep	General Location
99-004	012	603	688	East of Ross Ranch
99-017	CA-1	549	490	Concentrator Area

Table 4-13
Identified Barrier Deficiencies

Sample ID	Segment ID	Prescribed Barrier Thickness (in.)	Measured Barrier Thickness (in.)	General Location
99-001	001	12	10.5	Elizabeth Park
99-005	015	12	9.5	Ross Ranch
99-008	021	12	6	Near Ross Ranch
99-009	026	12	11	East Kellogg

Table 4-13
Identified Barrier Deficiencies

Sample ID	Segment ID	Prescribed Barrier Thickness (in.)	Measured Barrier Thickness (in.)	General Location
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99-023	080	12	11	Smelterville
99-024	085	12	9.5	Smelterville
99-030	150	6	4.5	Near West End of the Site

B. Deficiencies Identified

The results presented in the 1999 Sampling Report identify seven segments of the UPRR that apparently have barriers that do not meet prescribed barrier thickness requirements. The locations of these segments are presented in Table 4-13.

Since work on the UPRR has not been certified, the UPRR has not yet been incorporated into the ICP. The ICP has formal procedures for monitoring construction and other activities on remediated areas of the Site. Since the UPRR is not covered by the ICP, utility crossings have apparently not been monitored carefully and the potential for recontamination by other activities, such as placement of snow removed from contaminated residential areas on the UPRR, has not been adequately assessed.

The information and evaluation of the potential for contaminant tracking due to lack of access controls along the UPRR that may impact protectiveness of the Populated Areas of the Bunker Hill site, please refer to the Bunker Hill Populated Areas Operable Unit First Five Year Report.

C. Recommended Improvements

Segments of the UPRR with barriers that apparently do not meet thickness requirements should be assessed in the following manner:

- Re-sample each deficient segment to verify that the barrier thickness is as reported in the 1999 Sampling Report
- For segments with confirmed barrier thickness deficiencies, evaluate the magnitude of the deficiency, the potential impact of the deficiency on protectiveness, and the need for additional remedial action
- For segments that are identified as needing additional remedial actions, prepare a plan for the proposed remedial actions and implement the plan
- Conduct confirmation sampling during or following plan implementation to verify that barrier thickness requirements have been met

Since the majority of the UPRR remedial action has been completed, Union Pacific should proceed with preparation and implementation of the O&M plan discussed in the 1995 Work Plan. In addition to discussing inspection and maintenance of the

UPRR, the plan should also address the requirements of the ICP and the transfer of O&M responsibilities to new owners.

To prevent recontamination of the UPRR, an interim program needs to be developed to manage construction and other activities occurring within remediated areas of the UPRR. This program should be similar to the existing ICP and should be maintained in place until remedial actions are certified as complete and the UPRR is incorporated into the ICP.

4.3.11 Milo Gulch and Reed Landing Remedial Action

4.3.11.1 Introduction and Background

Milo Creek drains an approximate 4 square mile watershed located above and into the towns of Wardner and Kellogg and eventually discharges into the SFCDR. For the purposes of this initial 5-year review document, the Milo Creek watershed will be discussed in two segments, the upper watershed and the lower Milo Creek piping system beneath the towns of Wardner and Kellogg.

A. Upper Milo Watershed

Figure 9 shows the upper Milo Creek watershed that comprises about 2 square miles and consists of forested and clear-cut areas, mine dumps, and some industrial mining areas (the Reed Landing). In the upper reaches of the basin, there are three forks of Milo Creek (West, South and Upper) that join to form the main stem of Milo Creek. Prior to the remediations discussed in this report, Milo Creek flowed in a steep narrow canyon with heavy bedload (sediment, gravel, and rocks transported downstream by the force of water). The watershed crest at Wardner Peak is at approximately 6,300 feet mean MSL and drops to 2,300 feet MSL in Kellogg.

Historically, the upper Milo Creek watershed primarily supported mining and logging. Mine dumps, portals, access roads, hoists, and other industrial mining features are located throughout this area and have impacted Milo Creek's water quality and discharge over the years. A large surface depression resulting from underground block caving mining techniques is located in the western portion of the upper Milo watershed and is referred to as the Guy Cave Area. West Milo Creek flows into this surface depression and into the underground mine workings. In addition, several faults are located in the upper Milo watershed that cross the various forks of Milo Creek. It is believed that these fault zones and the close proximity of the extensive mine workings beneath this area result in significant surface water infiltration into the mine workings. This clean surface water is then changed through chemical reactions with pyrite and oxygen to acid mine drainage that eventually requires treatment at the CTP.

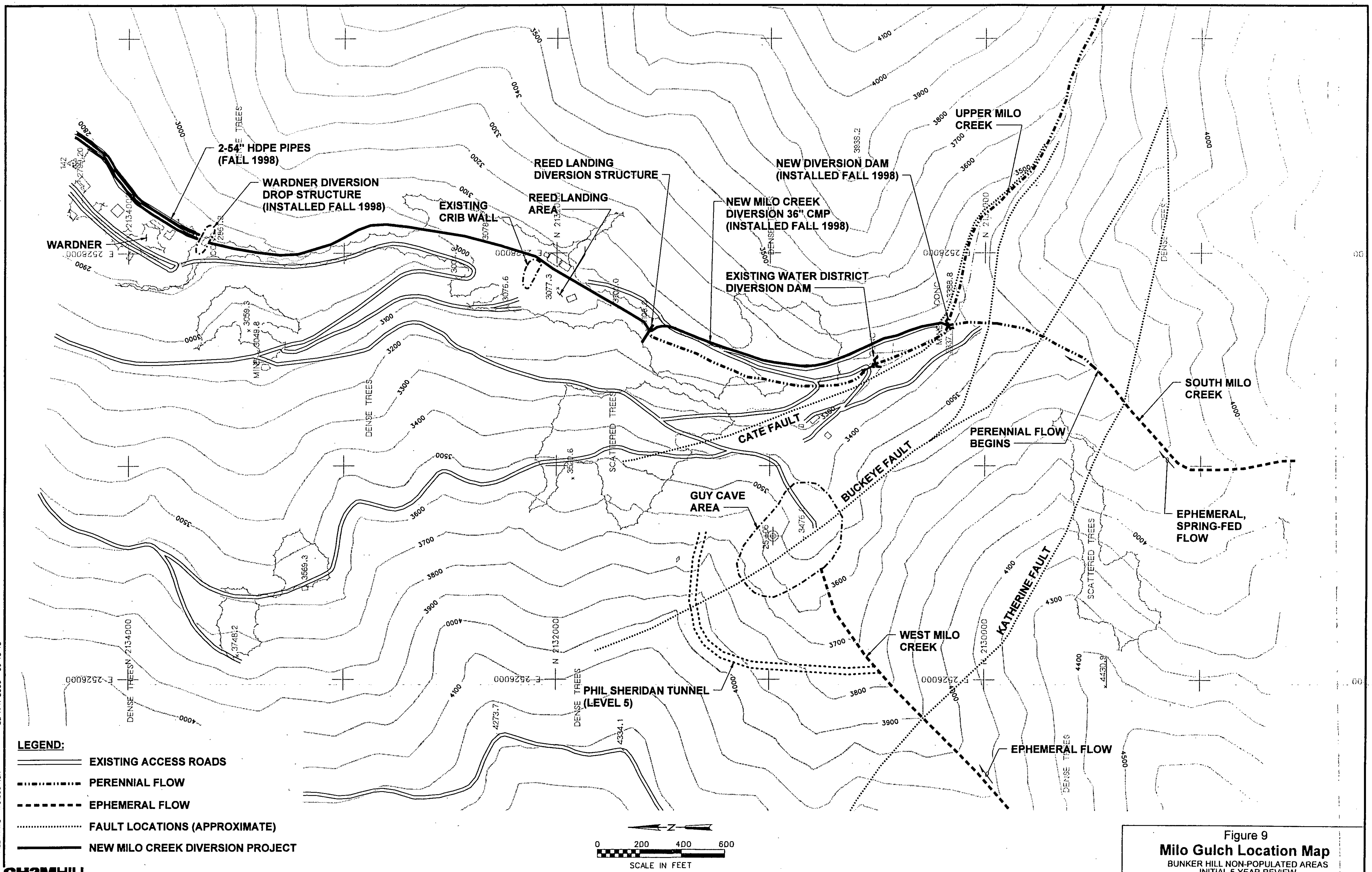

Figure 9
Milo Gulch Location Map
BUNKER HILL NON-POPULATED AREAS
INITIAL 5-YEAR REVIEW

The Reed Landing consists of a mine dump located midway up the watershed that filled Milo Creek in the early days of the Bunker Hill Mine Complex. A 4x4 box concrete culvert conveyed Milo Creek through the dump or "landing." A screen or "grizzly" made of railroad rails was placed over the entrance of the box culvert to restrict bedload (rocks and woody debris) from entering the culvert. During flood events, a backhoe would remove debris from the grizzly to ensure that water could enter into the culvert. During the 1997 flood event that caused substantial damage to the downstream infrastructure for Milo Creek, debris overwhelmed the backhoe's ability to keep the grizzly clear and it overtopped the culvert. Discussions with workers at the scene suggested that debris, not flood water, was the major cause of problems at the Reed Landing. One exception was a roof cave-in of the box culvert that was repaired by the Mine Owner. This repair was consistent with the Mine Owner's responsibility to operate and maintain the Reed Landing and it's components, including the approximately 100-foot high crib wall that held up the northern face of the mine dump and the 4 x 4 box culvert.

A second grizzly structure was constructed in Milo Creek approximately 300 feet above the town of Wardner to screen excessive bedload prior to flow entering the 48-inch corrugated metal pipe system that conveyed Milo Creek beneath Wardner and Kellogg.

B. Lower Milo Creek Piping System

As Milo Creek enters the town of Wardner at the lower grizzly, it flowed underground through a combination of open channels, 48-inch concrete pipe, 48-inch corrugated metal pipe, and 4-foot by 4-foot box culverts. Through the town of Kellogg, Milo Creek was totally contained by similar piping materials as those used through Wardner.

Severe flood damage to the existing Lower Milo Creek piping system occurred during a major runoff event in May 1997. Debris accumulations plugged the grizzlies and eventually resulted in failure of the Milo Creek subsurface conveyance structures downstream in Kellogg. Heavy bedload and debris plugged culvert and pipe systems and resulted in several blowouts of culverts, pipe failures, and the creation of sinkholes. In addition, lead-contaminated surface water flooded through many properties and recontaminated areas that had previously been remediated as part of the Populated Areas residential soil ROD. The affected properties were remediated by the Federal Emergency Management Administration (FEMA) and Idaho Bureau of Disaster Services (BDS) under a Presidential Declaration. More than $500,000 in remedial activities were required to remove the contaminated sediment from properties in Kellogg.

4 3.11.2Review of ROD, ESDs, and Rod Amendment

Requirements for the Milo Gulch and Reed Landing are summarized in Table 4-14.

Table 4-14
Milo Gulch and Reed Landing Remedial Actions

ROD Requirement	Remedial Action Objective/Goal	Document
1. Channelize and line Milo Creek from the Wardner Water System intake to the culvert that directs flow beneath Wardner and Kellogg	1. Minimize contact between Milo Creek surface water, tailings, and waste rock on the gulch floor	ROD 9.2.1
	2. Reduce contaminant transport to the SFCDR as suspended sediment in runoff events	ROD 9.2.1
	3. Minimize surface water infiltration into the underlying Bunker Hill mine workings	ROD 9.2.5
2. Financial contribution to the reconstruction of the underground Milo Creek pipeline project beneath Wardner and Kellogg	Minimize the potential for recontamination of previously remediated residential yards.	ESD 4-98

As noted in the above table, the April 1998 ESD modifies the upper Milo Creek remedy by including EPA participation in the reconstruction of the underground Milo Creek pipeline system beneath Wardner and Kellogg. As noted above, the pipeline system was damaged and breached in May of 1997 during a flood event resulting in the recontamination of approximately 50 remediated yards and over 5 miles of right-of-way in Wardner and Kellogg with soil and sediment containing up to 14,000 mg/kg lead. Costs associated with remediation of the recontaminated areas was estimated at about $500,000. The cost to replace the pipeline system was estimated at $10 million, toward which EPA contributed $2,000,000. The State of Idaho managed the implementation of this multi-agency-funded project through the Bureau of Disaster Services and other State agencies.

4.3.11.3Description of Remedial Actions

A. Removal of Waste Rock and Tailings from Portions of the Milo Creek Basin

A mine waste rock and tailings removal project within the stretch of Milo Creek between the Water District dam and the Reed Landing grizzly was conducted in the fall of 1995 by the Bunker Hill mine owner. EPA and the State of Idaho participated in scope discussions with the mine owner and agreed that the tailings removal action would meet the objectives of the ROD for Milo Creek (minimize contact of surface water with contaminants and reduce contaminated sediment transport to the SFCDR). Approximately 30,000 cubic yards of mine waste and tailings were removed from the creek bank areas (a 50 percent increase over ROD estimated removal quantities). These materials were transported to the Guy Cave and used as backfill in this surface depression as a means to improve grading in this area.

B. Upper and Lower Milo Creek Improvements

A water diversion project was implemented in the latter part of 1998 through 1999 on the main stem of Milo Creek for the purposes of minimizing contact between Milo Creek surface water and tailings/mine waste rock on the valley floor and to reduce infiltration into the mine workings that underlie the stretch of Milo Creek between the confluence with the South Fork of Milo Creek and Reed Landing. This water diversion piping project satisfies the ROD requirement to line Milo Creek.

This project was partially funded by EPA and FEMA as a response to the flooding that occurred in the spring of 1997. This Milo Creek diversion project consisted of installing a new diversion dam above the existing Wardner Water District dam and hard-piping the flow from the upper and main stem of Milo Creek down to another diversion structure located at the Reed Landing. From the Reed Landing structure, the Milo Creek flow is piped down to the Upper Wardner structure prior to discharging into a new piping system beneath the towns of Wardner and Kellogg. Based on funding constraints, this surface water diversion system was designed for a flood recurrence interval of between 2 and 5 years maximum. The twin 54-inch pipes that flow beneath Wardner and Kellogg were designed for a 100-year recurrence interval.

C. Reed Landing

In 1999, EPA, the State of Idaho, and the USACE implemented a remediation project at the Reed Landing area to enhance the area's drainage capacity and to increase the stability of the landing. Because of the poor structural condition of a downstream 4-foot by 4-foot overflow culvert, it was believed that the failure of this culvert could result in overland flow across the Reed Landing and significant erosion of the mine waste rock and tailings that contained in the Landing. The Reed Landing project was designed to mitigate this potential for overland flow by constructing an overflow channel down the Reed Landing that made the existing overflow culvert unnecessary.

The Reed Landing remediation project included the following components:

- Removal of the timber crib-walls and regrading the nearly vertical face of the landing to at least 2 horizontal to 1 vertical (2H:1V). Excess soil from the regrading (mine waste rock and tailings predominantly) were transported to the Guy Cave and used for backfill to enhance surface water drainage in this area. This area is recommended to be evaluated to determine if a clean soil cap over the waste material is necessary.

- Construction of a reinforced concrete channel across the Reed Landing fill that has an average width of 8 feet and average channel wall height of 5.5 feet. The channel alignment had two horizontal curves that were banked and super-elevated as necessary to confine the flow in the channel. A stilling basin was constructed at the downstream end of the channel to dissipate energy prior to the creek entering a 700-foot long riprap lined channel that was constructed to join the existing Milo Creek drainage.

- Incidental items such as debris trash-racks and debris basins were also constructed on the upstream end of the Reed Landing.

4.3.11.4 Operations and Maintenance

A watershed district was formally established in 1998 by a vote of people residing in Kellogg and Wardner. The district, which is managed by three directors, has the responsibility to conduct regular O&M activities as necessary to insure the Milo Gulch stormwater control system continues to function as designed. Funding for the activities is provided by annual property assessments. A formal O&M plan is being prepared that will likely include:

- Periodic inspection and clean out of culverts, sedimentation basins, and diversion structures.
- Inspection of entire gulch after major storm events.
- Inspection, and repair if necessary, of damage to channels or structure.
- Inspection, and repair if necessary, of fences and other safety features.
- Inspection and repair if necessary, of maintenance access routes.

4.3.11.5 Assessment of Remedial Actions

A. Remedy Performance

As noted above, the Milo Gulch remedies were constructed between 1995 and 1999. The performance of drainage systems such as those installed in Milo Gulch and at the Reed Landing (especially the natural channel portions) require a period of years to evaluate the effectiveness as the system incurs varying storm events.

However, both the Milo Creek water diversion and Reed Landing projects were implemented according to design plans and specifications, and have to date performed as designed. These projects, including the removal of waste rock and tailings from portions of the Milo Creek Basin, have minimized contact of surface water with contaminants, and reduced the potential for contaminated sediment to be transported downstream. It is recommended that ongoing monitoring continue to gather data to evaluate remedy performance and whether modifications to the remedy are necessary.

B. New Information

As discussed in Section 4.3.8 of this report, EPA is currently evaluating additional remedial actions that may be implemented in the upper Milo basin to further reduce surface water infiltration into the underlying mine workings. The potential additional remedial actions would focus on diverting the surface water flows of the West and South Milo Creek around existing fault zones and bypassing the Guy Cave area. If it is decided to implement these remedial actions, they will not be part of the Non-Populated Areas ROD, but rather a separate ROD to specifically address the Bunker Hill mine water and long-term treatment needs at the Site.

C. Identify Deficiencies

No deficiencies were noted with respect to the Milo Gulch and Reed Landing remediations.

D. Recommended Improvements

Evaluate whether a clean cap is necessary on the contaminated materials disposed in the Guy Caves area.

5.0 5-Year Review Findings and Recommendations

5.1 Identification and Review of Newly Promulgated or Revised Regulatory Standards

The remedies selected in the ROD are intended to be protective of human health and the environment and to comply with Federal and State standards that are applicable or relevant and appropriate requirements (ARARs). As part of this initial 5-year review, the ARARs identified in the 1992 Non-Populated Areas ROD were reviewed and any changes or newly promulgated standards were identified and summarized in Appendix B.

As shown in Appendix B, there are five revisions to existing ARARs or to be considered (TBC) documents initially identified in the ROD, and two newly identified regulations or TBCs. These revisions and newly identified materials do not affect the protectiveness of the remedy selected in the 1992 ROD; therefore, they are not being adopted at the current time as ARARs or TBCs for the Site. Refer to Appendix B for more detailed information.

As noted in section 4.3.8 of this report, a draft Total Maximum Daily Load (TMDL) for dissolved cadmium, lead and zinc in surface waters of the Coeur d'Alene Basin (Basin) was jointly released for public comment by EPA and the State of Idaho in April 1999. Once finalized, the TMDL will be evaluated to determine if it meets the NCP standard for adoption as an applicable or relevant and appropriate requirement (ARAR).

The TMDL establishes long-term water quality goals for discrete (e.g., discharging from a pipe) and non-discrete sources (e.g., waste piles and floodplain tailings) of metals contamination to the SFCDR. A specific amount of allowable metals loading has been proposed for the Bunker Hill Central Treatment Plant (a discrete source) and is further discussed in section 4.3.8 of this report. Non-discrete sources in the Basin have not been assigned specific allowable loadings. Rather, a single allocation has been assigned to all non-discrete sources within various segments of the SFCDR. An evaluation of metals loading from all non-discrete sources in the Basin is part of the Coeur d'Alene Basin RI/FS. Based upon this evaluation, the impacts of cleanup actions on improving water quality, and the results of ongoing surface water and ground water monitoring, additional cleanup actions may need to be considered in the future for the Non-Populated Area of the Site. Prior to undertaking any such actions, the relative loadings from all non-discrete sources within the Basin would be evaluated to determine which actions have the greatest potential to reduce non-discrete sources of metals loadings to the SFCDR, and thereby achieve the TMDLs.

5.2 Assessment of Remedial Actions

Table 5-1 provides a summary of this initial 5-year assessment for the Non-Populated Areas of the Site. Included in the table are dates during which particular activities or remedial actions were conducted, work that is remaining to complete the remedial action, a general assessment of the performance or protectiveness of the remedy, and any deficiencies noted during this 5-year review.

5.3 Recommendations and Required Actions

Table 5-2 summarizes recommendations and required actions that have been identified during this initial 5-year review. These recommendations and actions were identified to improve remedy performance or protectiveness in alignment with the Remedial Action Objectives and performance standards for this Site. Specifics of these activities, if not provided for in the ROD, the ROD Amendment, or in either of the two ESDs, may need to be documented in a separate decision document.

Table 5-1
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Activity				
ICP Program within Non-Populated Areas	1994 - present	As part of individual RAs, placement of ICP barriers and fences at various Site locations	As has been conducted to date, EPA, IDEQ, and USACE will continue to provide oversight of ICP-related work in the Non-Populated Area of the Site	None noted.
Health and Safety During Remediations	1994 - present	Ongoing	Successful implementation of safety programs as evidenced by no lost time or injuries reported for prime contractor	None noted.
Operations and Maintenance of Remedies	1994 - present	Day-to-day O&M currently provided by subcontractors to USACE.	O&M being performed adequately.	None noted.
	1999 - 2000	IDEQ in process of preparing Site-Wide O&M Plans. All O&M responsibilities eventually turned over to IDEQ.	Not applicable (NA)	NA
Site-Wide Monitoring	1987 - 1993 1996-present	Ongoing monthly and quarterly programs, yearly trend analysis reports	Insufficient data exists at this time to establish trends between data and effectiveness of remedies.	None noted.

Table 5-1
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Hillsides Monitoring Program	1999 - present	Ongoing monitoring, annual reports and workshops to discuss data modifications to RA approach, if necessary	Adaptive management approach working adequately.	None noted.
Smelter Closure Observational Approach	1997 - present	Ongoing monthly sampling, yearly trend analysis reports	As expected, insufficient amount of post-remediation data to conclusively determine trends at this time.	None noted.
Remedial Action				
Hillsides RA	1990 – 1994 (PRPs)	None	Terracing was effective. Planting was marginally effective.	None noted.
	1996 – present (Fund-lead)	Re-vegetation programs planned through 2001, adaptive management afterwards. Upper Industrial Landfill yet to be removed.	Adaptive management approach working adequately. Raveling hillslopes above Smelterville and Wardner residential areas may need additional monitoring and/or cleanout to reduce potential for recontamination.	None noted.

Table 5-1
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Gulches RA	Grouse: 1997	None noted.	All Gulches:	
	Gov't: 1996-1998	Lower Gov't Creek re-alignment. Riparian planting.	Access control throughout gulches and hillsides should be evaluated to determine appropriate level of concern (i.e., trail bikers have been reported to use Grouse Gulch for recreation).	Determine need for access restriction and if current access is deficient implement greater controls.
	Magnet: 1995-1998	Magnet Creek channel through A-4 gypsum pond.		
	Deadwood: 1995 – 1998	Riparian planting.	Remedies are performing as expected. Creek channels are expected to become more stable with time.	None identified.
Smelterville Flats RA	1996 – 1998	Plantings in Flats area.	Remedy is performing adequately. Channel of SFCDR is expected to become more stable with time.	Truck portion of RV Park needs to be re-capped to prevent direct contact and dispersion of dust.
		Re-capping of Truck Stop area.		
		South of I-90 storm drain and ICP capping.		
		Special Area Management Plan as prepared by State of Idaho		
	1999 - present	East of Theater Bridge tailings removals and capping		

Table 5-1
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Central Impoundment RA	1995 – present	Final closure to be completed in 2000. Ongoing monitoring of CIA seeps.	No assessment at this time; remedy is only partially complete	None at this time.
Page Pond RA	1997 - present	Majority of RA yet to be completed: Tailings removal, placement of clean fill, modifications to South and North Channels, construction of outlet and discharge structures to SFCDR, construction of internal berms in West Swamp.	No assessment at this time; remedy is only partially complete	PRP program for baseline and routine groundwater and surface water monitoring was reviewed by EPA and found to be deficient. PRPs are required to revise program and re-submit for EPA and State review.
Industrial Complex RA	1995 – 1998 Construction season 2001	Borrow Area/ICP Landfill construction. Ongoing monthly monitoring of groundwater wells as part of observational approach.	Remedy is performing adequately.	None noted.
Mine Operations Area RA	1994	None noted.	Remedy is performing adequately.	None noted.
Boulevard RA	1997	None noted.	Remedy is performing adequately.	None noted.

Table 5-1
Summary of Initial 5-Year Assessment

Activity or Remedial Action (RA)	Dates of Activity or RA	Work Remaining	Assessment	Deficiency of the Activity or Remedial Action
Railroad Gulch RA	1997	None noted.	Remedy is performing adequately.	None noted.
Central Treatment Plant RA	1994 - present	Ongoing O&M	Remedy is performing adequately.	None noted.
Bunker Creek	1996 - 1997	ICP capping on west end of Bunker Creek project area. Emergency overflow channel to Gov't Creek.	Remedy is performing adequately. Protectiveness from direct contact is not yet achieved until all areas receive ICP cap.	None noted.
UP Railroad RA	1995 - 1999	A portion of the UPRR right-of-way used as a haul road remains to be remediated by EPA.	Remedy is performing adequately; verification sampling indicated that none of the sampled areas exceeded 1,000 mg/kg lead. 1999 Sampling Report did indicate that 7 areas sampled did not have the required thickness of ICP barrier.	Increasing barrier thickness in some locations is warranted as indicated by 1999 sampling.
Milo Creek and Reed Landing RA	1995 - 2000	None noted.	Remedy appears to be performing adequately, however, much of the remedy has been constructed in last 2 years and will require more time to determine effectiveness and protectiveness.	None noted.

Table 5-2
Recommendations and Required Actions

Required Action	Party Responsible	Proposed Milestone Date	Oversight Agency	Potential to Affect Protectiveness upon Completion (X)
Activity				
Site-Wide Monitoring Program: Re-confirm that current monitoring program is gathering appropriate data to address remedy performance across the Site.	EPA - IDEQ	3rd quarter 2000	EPA - IDEQ	
Site-Wide Monitoring Program: Continue monitoring program, conduct trend analyses, prepare annual trend reports.	IDEQ	Ongoing, trend report in first quarter 2001	EPA	
Hillsides Monitoring Program: Continue monitoring program, conduct trend analyses/reports, conduct annual stakeholder workshops.	EPA	Ongoing, trend report in first quarter 2001	IDEQ	
Smelter Closure Observation Approach Monitoring: Continue monitoring program, conduct trend analyses, prepare annual trend report.	IDEQ: sampling EPA: trend analyses, reports	Ongoing Trend report in first quarter 2001	EPA: sampling IDEQ: trend analyses, reporting	
Site-Wide Biological Monitoring: Implement biological monitoring program for plants and wildlife.	EPA - U.S. Fish and Wildlife	2000 - 2004	IDEQ	X

Table 5-2
Recommendations and Required Actions

Required Action	Party Responsible	Proposed Milestone Date	Oversight Agency	Potential to Affect Protectiveness upon Completion (X)
O&M Plans – Government Funded RAs: Prepare O&M plans *including need for on-going inspections and measures to monitor and* address recontamination potential.	IDEQ	4th quarter 2000	EPA	X
O&M Plans – PRP Funded RAs: Review and approve PRP-prepared O&M plans including need for on-going inspections and measures to monitor and address recontamination potential.	PRPs	4th quarter 2000	EPA - IDEQ	X
Remedial Action				
Hillsides Performance Standards: Evaluate the need for an ESD or ROD Amendment to address the adaptive management approach for establishing hillsides' performance standards.	EPA	Ongoing	IDEQ	X
Smelterville and Wardner Hillslopes: Inspection of catchment wall areas to determine if additional action is necessary to prevent recontamination of remediated yards.	IDEQ	Ongoing	EPA	X
Hillsides – Access Control: Assess the need for additional access control to hillsides and gulches.	EPA	2001	IDEQ	X
Gulch Remedial Actions: Conduct yearly surveys to evaluate channel and surface barrier stability, success of vegetation, and surface water and groundwater quality	EPA - USACE	Ongoing	IDEQ	X
Guy Caves Area (Milo Creek): Evaluate the need to cover mine waste and tailings disposed in Guy Caves with clean material	EPA	4th quarter 2000	IDEQ	X

Table 5-2
Recommendations and Required Actions

Required Action	Party Responsible	Proposed Milestone Date	Oversight Agency	Potential to Affect Protectiveness upon Completion (X)
Page Pond: Revisions to monitoring approach.	IDEQ	By construction season 2000	EPA	X
Lined Pond: Clean out sediment at bottom of pond.	EPA - USACE	Construction season 2000	IDEQ	
Smelterville Flats: Evaluate the need for an ESD or ROD Amendment to address the increased tailings removal on the Flats and the decision to defer construction of the groundwater and surface water wetland treatment systems.	EPA	Second 5-year review, ~2004	IDEQ	X
Page Mine Waste Rock Dump: Evaluate the need for additional efforts to encourage vegetative growth.	EPA	3rd quarter 2000	IDEQ	X
Central Impoundment Area: Evaluate the need for an ESD or ROD Amendment to address collection of the deferment of construction of a seep collection system.	EPA	Second 5-year review, ~2004	IDEQ	X
Union Pacific Railroad: Address barrier thickness deficiencies as necessary based on 1999 Sampling Report.	UPRR	Construction season 2000	IDEQ	X
Government Gulch Groundwater and Surface Water: Evaluate the need for an ESD or ROD Amendment to address groundwater control and collection systems and creek lining in Government Gulch as described in the ROD	EPA	Ongoing	IDEQ	X

6.0 Statement of Protectiveness

The remedy being implemented in the Non-Populated Area operable unit of the Bunker Hill Superfund Site is expected to be protective of human health and the environment upon completion, provided that the required actions identified in Table 5-2 are implemented. Although the remedy hasn't been fully implemented, immediate threats to human health and the environment have been addressed by source removal efforts, capping activities, erosion control measures, ongoing treatment of mine water, and institutional controls. These efforts have reduced or eliminated the potential for humans and animals to have direct contact with soil/source contaminants, have reduced opportunities for transport of contaminants by surface water and air, and are expected to provide surface and groundwater quality improvements over time throughout the site. Groundwater and surface water quality will continue to be monitored to assess improvements over time. The need for surface and groundwater collection and treatment measures, as indicated in the ROD, will be evaluated as part of the second phase of cleanup actions at the site, following the completion of source removal, capping, and erosion control efforts.

7.0 Next 5-Year Review

Statutory requirements of CERCLA require ongoing 5-year reviews for Superfund sites once remediations have been initiated. The next review will be conducted within 5 years of the completion date of this 5-year review report. The completion date is the date of the signature shown on the cover of this report. This subsequent review will cover all remedial work, monitoring, and O&M activities conducted at the Site. This subsequent 5-year report is expected to summarize more detailed information on protectiveness of the remedy since five additional years of monitoring data and annual remedy inspection reports will then be available to judge remedy performance.

8.0 References

8.1 General Overall References

Amendment to the Record of Decision for the Bunker Hill Mining and Metallurgical Complex (Non-Populated Areas) Superfund Site, September 3, 1996.

Compensation, and Liability Act (CERCLA) Section 121(c), as amended.

Contingency Plan (NCP) Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR).

Draft Comprehensive 5-Year Review Guidance (EPA, October 1999).

Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site, Shoshone County, Idaho: two separate ESDs, January 1996, April 1998.

U.S. Environmental Protection Agency. *Record of Decision, Bunker Hill Mining and Metallurgical Complex Residential Soils Operable Unit, Shoshone County, Idaho.* August 1991.

U.S. Environmental Protection Agency. *Record of Decision, Bunker Hill Mining and Metallurgical Complex, Shoshone County, Idaho.* September 1992.

8.2 Site-Specific References

State Suferfund Contract and Two Phase Implementation Stragety (Section 3.5)

Idaho Department of Health and Welfare. 1995. State Superfund Contract (SSC) and Corresponding Documents. May 12, 1995.

Bunker Hill Superfund Site 5-Year Review for Populated Areas (Section 4.1.1)

TerraGraphics Inc., March 2000. *Draft 1999 Five-Year Review Reports*.

Application of the Institutional Controls Program (Section 4.1.3)

McCulley, Frick, & Gilman, Inc., 1999. *Bunker Hill Superfund Site 5-Year Review Report,* prepared for the Upstream Mining Group, November 12, 1999.

TerraGraphics, Inc., *Final 1999 Five year Review Report, Bunker Hill Superfund Site,* prepared for the Idaho Department of Health and Welfare, Division of Environmental Quality, April 2000.

Health & Safety Review (Section 4.1.3)

Morrison Knudsen, 1999, *Bunker Hill Remedial Action Project Closure Report; Appendix G-- Final Safety Report*, February 10, 1999.

Fink, Rich/USCOE, 2000, *Health and Safety*: telephone interview from Tami Thomas/CH2M HILL, February 14, 2000.

Surface Water, Groundwater, and Air Monitoring (Section 4.2.1)

CH2M HILL, 1998, *Site-Wide Monitoring: Time Series Plots and Initial Evaluation of Data Quality Trends*: memorandum prepared for USEPA, February 10, 1998.

Federal Register. Vol. 62, No. 138, July 18, 1999. 50 CFR Part 50, National Ambient Water Quality Standards for Particulate Matter, Final Rule.

Morrison-Knudsen, 1999, *Bunker Hill Remedial Action Project Closure Report*, February 10, 1999.

TerraGraphics, 1999, *DRAFT Bunker Hill Site-Wide Monitoring of Groundwater and Surface water Trend Analysis*: report prepared for Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho, August, 1999.

U.S. Environmental Protection Agency, 1990, *Bunker Hill Superfund Site Administrative Order on Consent: Hillsides Re-vegetation/Stabilization Removal Action*: October 1, 1992.

U.S. Environmental Protection Agency. *Comprehensive Five-Year Review Guidance*. EPA 540R-98-050. OSWER Directive 9355.7-03B-P. Draft, October 1999.

U.S. Environmental Protection Agency. *National Recommended Water Quality Criteria Correction*, EPA 822-Z-99-001. April 1999. Office of Water 4304.

U.S. Environmental Protection Agency. Region X. *Draft Technical Support Document, Total Maximum Daily Load for Dissolved Cadmium, Dissolved Lead and Dissolved Zinc in Surface Waters of the Coeur d'Alene Basin*. April 1999.

Hillsides Monitoring Program (Section 4.2.2)

A. Documents

CH2M HILL, 1999, *Bunker Hill Hillsides Re-vegetation Conceptual Plan and Monitoring Plan* - Final: report prepared for USEPA, December, 1999.

B. Interviews

White, Tim/CH2M HILL, 2000a, Hillsides Monitoring Program: e-mail interview from Tami Thomas/CH2M HILL, January 28, 2000.

White, Tim/CH2M HILL, 2000b, Hillsides Monitoring Program: phone message interview from Tami Thomas/CH2M HILL, January 31, 2000.

Smelter Closure Observational Approach Monitoring (Section 4.2.3)

A. Documents

CH2M HILL, 1996a, *Smelter Area Closure Predesign Report – Bunker Hill Superfund Site, Kellogg, Idaho*: report prepared for USEPA, April, 1996.

CH2M HILL, 1996b, *Smelter Closure Area Observational Approach for Seepage Monitoring*: memorandum prepared for USEPA, June 26, 1996.

B. Interviews

Turner, Alta/CH2M HILL, 2000, Smelter Closure data: e-mail interview from Tami Thomas/CH2M HILL, February 1, 2000.

Hillsides Remedial Actions (Section 4.3.1)

A. Documents

CH2M HILL, 1999, Bunker Hill Hillsides Revegetation Conceptual Plan and Monitoring Plan: Work Assignment No. 31-68-0NX9, December 1999.

Dames & Moore, 1990, Bunker Hill Site RI/FS. Vegetation Growing Condition Analysis Subtask 5.4: Volumes. I and II. Denver, Colorado, May 14, 1990.

Dames & Moore, 1990, Bunker Hill Site RI/FS. Revised Technical Memorandum, Evaluation of Erosion and Effects of Vegetation on Erosion Potential: Denver, Colorado, May 14, 1990.

McCulley, Frick, & Gilman, 1992, Bunker Hill Superfund Site Remedial Investigation Report (RI): Volumes I, II, and III. May 1, 1992.

Panhandle Health District, 1996, Contaminant Management Rules: January 1, 1996.

Panhandle Health District, 1999, Institutional Controls Program Summary.

Pintlar, 1992, 1991 Bunker Hill Hillside Project Evaluation Report: January 1992.

TerraGraphics, Final 1999 Five Year Review Report Bunker Hill Superfund Site, prepared for the Idaho Department of Health and Welfare, Division of Environmental Quality, April 2000.

U.S. Environmental Protection Agency, 1990, Administrative Order on Consent: Hillsides Re-vegetation/Stabilization Removal Action: EPA Docket No. 1090-10-01-106, October 3, 1990.

U.S. Environmental Protection Agency, 1996, Memorandum of Agreement between the U.S. EPA Region X, Hazardous Waste Division and the Idaho Department of Health and Welfare, Division of Environmental Quality for the Bunker Hill Superfund Site; Comprehensive Cleanup Plan: March 17, 1996.

B. Interviews

Cobb, Jerry/Panhandle Health District, 2000, *Applicability of ICP to Hillsides*, Smelterville Flats, Gulches, telephone interview by Tami Thomas/CH2M HILL, January 5, 2000.

Hudson, Bill/CH2M HILL onsite representative for EPA, 1999, Hillsides/Mine waste dumps status, telephone interview by Tami Thomas/CH2M HILL. December 28, 1999.

Stoupa, Joan/CH2M HILL project manager for Bunker Hill Site under EPA RACS Contract, 1999, Summary of Actions Performed at Sub-areas: Hillsides, Gulches, Smelterville Flats, Site-Wide Monitoring, personal interview by Tami Thomas/CH2M HILL. December 22, 1999.

White, Tim/CH2M HILL Hillsides Re-vegetation design manager, 1999, Hillsides Re-vegetation Status, personal interview by Tami Thomas/CH2M HILL, December 30, 1999.

Smelterville Flats Remedial Action (Section 4.3.3)

A. Documents

CH2M HILL, 1996, Bunker Hill Final Smelterville Flats Tailings Removal – Thirty Percent Design Report: report prepared for USEPA, Bellevue, Washington, December 2, 1996.

CH2M HILL, 1996, Government Gulch Stream – Design Memorandum: memorandum prepared for USEPA, Bellevue, Washington, July 31, 1996.

CH2M HILL, 1996, Bunker Hill Soil Removal Design and Instructions: plans and instructions prepared for USEPA, Bellevue, Washington, July 1996.

Dames & Moore, 1990, Bunker Hill Site RI/FS; Revised Technical Memorandum, Evaluation of Erosion and Effects of Vegetation on Erosion Potential: Denver, Colorado, May 14, 1990.

McCulley, Frick, & Gilman, 1992, Bunker Hill Superfund Site Remedial Investigation Report (RI): Volumes I, II and III, May 1, 1992.

McCulley, Frick, & Gilman, 1996, Bunker Hill Superfund Site Gypsum Pond A-4 Closure Final Remedial Design Report, April 1996.

Morrison Knudsen, 1999, Bunker Hill Remedial Action Project Closure Report, February 10, 1999.

Panhandle Health District, 1996, Contaminant Management Rules, January 1, 1996.

Panhandle Health District, 1999, Institutional Controls Program Summary.

Pintlar, 1992, 1991 Bunker Hill Hillside Project Evaluation Report January 1992.

TerraGraphics, 1999, Bunker Hill Small Projects Memorandum: memorandum to IDEQ and US COE, Kellogg, Idaho, June 30, 1999.

TerraGraphics, 1999a, Draft Interim Smelterville Flats, Bunker Hill Superfund Site Operation and Maintenance Manual: prepared for the State of Idaho DEQ, August 31, 1999.

TerraGraphics, 1999b, State Lead Activity Update/Summary, Operation and Maintenance Project Bunker Hill Superfund Site: memorandum, December 23, 1999.

U.S. Bureau of Mines, 1998, Bunker Hill Collected Water Wetlands Study: Interagency Agreement DW14957159-01-0 between the U.S. Environmental Protection Agency and the U.S. Bureau of Mines, September 14, 1998.

U.S. Environmental Protection Agency, 1990, Administrative Order on Consent: Hillsides Stabilization and Re-vegetation Work Plan: Submitted to U.S. EPA Superfund Branch Region X, Seattle, Washington, September 28, 1990.

U.S. Environmental Protection Agency, 1996, Memorandum of Agreement between the U.S. EPA Region X, Hazardous Waste Division and the Idaho Department of Health and Welfare, Division of Environmental Quality for the Bunker Hill Superfund Site; Comprehensive Cleanup Plan, March 17, 1996.

B. Interviews

Bourque, Tom/Terragraphics, 1997, Smelterville Flats, Special Areas Management Plan: letter report prepared for State of Idaho Department of Environmental Quality, June 12, 1997.

Chavez, Tony/McCulley, Frick & Gilman, 2000, East of Theater Bridge Work, telephone interview by Tami Thomas/CH2M HILL, January 7, 2000.

Cobb, Jerry/Panhandle Health District, 2000, *Applicability of ICP to Hillsides*, Smelterville Flats, Gulches, telephone interview by Tami Thomas/CH2M HILL, January 5, 2000.

Fitzgerald, Mike/TerraGraphics, 2000, CIA seeps, telephone interview by Tami Thomas/CH2M HILL, February 2, 2000.

Hudson, Bill/CH2M HILL onsite representative for EPA, 1999, East of Theater Bridge Removals, telephone interview by Tami Thomas/CH2M HILL, January 7, 2000.

Hudson, Bill/CH2M HILL onsite representative for EPA, 1999, Smelterville Flats Work Remaining, telephone interview by Tami Thomas/CH2M HILL, January 13, 2000.

Hudson, Bill/CH2M HILL onsite representative for EPA, 2000, Gulches and Misc. Questions: telephone interview by Tami Thomas/CH2M HILL, January 18, 2000.

Mullen, Tom/McCulley, Frick & Gilman, 2000, CIA/A-4 Gypsum pond, telephone interview by Tami Thomas/CH2M HILL, January 18, 2000.

Reimbold, Mike/CH2M HILL, 2000, A-1 Gypsum Pond: telephone interview by Tami Thomas/CH2M HILL, January 18, 2000.

Stoupa, Joan/CH2M HILL project manager for Bunker Hill site under EPA RACS contract, 1999, SAMP Questions, telephone interview by Tami Thomas/CH2M HILL, January 10, 2000.

White, Tim/CH2M HILL soil scientist, 1999, Hillsides Planting Status and Misc., December 28, 1999.

Zilka, Nick/IDEQ, 2000, Government Gulch Removals: telephone interview by Tami Thomas/CH2M HILL, January 18, 2000.

Central Impoundment Area Remedial Action (Section 4.3.4)

A. Documents

CH2M HILL, 1996a, Central Impoundment Area Closure – Thirty Percent Design Report, Bunker Hill Superfund Site, Kellogg, Idaho: report prepared for USEPA, Bellevue, Washington, November 1996.

CH2M HILL, 1996b, Bunker Hill, CIA Seepage Collection Technical Memorandum: technical memorandum prepared for USEPA, Seattle, Washington, March 20, 1996.

CH2M HILL, 1997, Central Impoundment Area Closure – Cover Design Technical Memorandum, Bunker Hill Superfund Site, Kellogg, Idaho: technical memorandum prepared for USEPA, Seattle, Washington, April 1997.

CH2M HILL, 1998, Bunker Hill, Central Impoundment Stormwater Management: technical memorandum prepared for USEPA, Seattle, Washington, December 14, 1996.

Morrison Knudsen, 1999, Bunker Hill Remedial Action Project Closure Report, February 10, 1999.

B. Interviews

Cobb, Jerry/Panhandle Health District, 2000, Applicability of ICP to Hillsides, Smelterville Flats, Gulches, telephone interview by Tami Thomas/CH2M HILL, January 5, 2000.

Page Pond Remedial Actions (Section 4.3.5)

CH2M HILL, Inc., 1999. *Draft Technical Memorandum. Page Pond Monitoring Recommendations Bunker Hill Superfund Site.* Draft technical memorandum prepared for USEPA, December 16, 1999.

McCulley, Frick & Gillman, Inc. (MFG), 1994. *Bunker Hill Superfund Site. Page Pond Closure: Draft Final Remedial Design Report.* Report prepared for Upstream Mining Group (UMG), September 1994.

McCulley, Frick & Gillman, Inc. (MFG), 1997. Diversion of Page Pond Wastewater Treatment Plan Effluent to West Page Swamp. Technical memorandum prepared for the UMG, June 17, 1997.

McCulley, Frick & Gillman, Inc. (MFG), 1999. *Bunker Hill Superfund Site. Page Pond Closure: West Swamp Tailings Removal and Diversion of PPWTP Effluent to West Swamp. Remedial Action Work Plan.* Report prepared for the UMG, April 1999.

Peterson, Scott. Idaho State Department of Environmental Quality. Telephone interview to obtain construction information regarding the removal and relocation of tailings from the West Beach area of the West Swamp, January 5, 2000.

Industrial Complex Remedial Action (Section 4.3.6)

CH2M HILL, Inc. 1996. Memorandum. Response to Review Comments to the Smelter Area Closure Predesign Report prepared for USEPA, July 25, 1996.

CH2M HILL, Inc. 1996. PTM Disposal Cell—Conceptual Design prepared for USEPA, May 16, 1996.

CH2M HILL, Inc. 1996. Smelter Area Closure Predesign Report prepared for USEPA, April 1996.

CH2M HILL, Inc. 1997. Borrow Area Management Plan Final Design (includes Technical Specifications and Drawings) – 100% Submittal prepared for USEPA, April 9, 1997.

CH2M HILL, Inc. 1997. Final Smelter Area Closure Construction Quality Assurance Plan prepared for USEPA, June 1997.

CH2M HILL, Inc. 1997. Final Smelter Area Closure Final Design Submittal Technical Specifications and Drawings prepared for USEPA, April 1997.

OHM Remediation Services Corp. 1995. Final Project Report - Removal of Select Structures from the Lead Smelter and Zinc Plant at the Bunker Hill Superfund Site prepared for USEPA, October 1995.

Morrison, Knudsen. 1999. Bunker Hill Remedial Action Project Closure Report prepared for USEPA, February 10, 1999.

Mine Operations and Boulevard Areas, Railroad Gulch Drainage (Section 4.3.7)

CH2M HILL, Inc. 1994b. Construction Documents for the Mine Operations Area Remedial Action, prepared for USEPA and BLP, August 1994.

CH2M HILL, Inc. 1996a. Technical Memorandum. Bunker Hill Soil Removal Design and Instructions, prepared for USEPA and U.S. Army Corps of Engineers. July 15, 1996.

CH2M HILL, Inc. 1996b. Technical Memorandum. ADDENDUM to Bunker Hill Soil Removal Design and Instructions, prepared for USEPA and U.S. Army Corps of Engineers. July 26, 1996.

CH2M HILL, Inc. 1996c. Soil Removal Areas Drainage Design – Boulevard and Magnet Gulch, prepared for USEPA and U.S Army Corps of Engineers. July 31, 1996.

CH2M HILL, Inc. 1997. North End Railroad Gulch Creek Design – Draft No. 2, prepared for USEPA. June 16, 1997.

Central Treatment Plant (Section 4.3.8)

CH2M HILL, Inc. 1994. *Contract Documents for Construction of a Lined Storage Pond,* prepared for USEPA, August 1994.

CH2M HILL, Inc. March 1997. *Lined CTP Influent Pond No. 2 and Sludge Pond Facility,* prepared for USEPA, March 1997.

CH2M HILL, Inc. December 1997. *CTP High Density Trial Report, Bunker Hill Superfund Site,* prepared for USEPA, December 1997.

CH2M HILL, Inc. January 1997. *Technical Memorandum. Failure Modes and Effects Analysis – Central Treatment Plant,* prepared for USEPA, January 7, 1997.

CH2M HILL, Inc. 1996b. *Bunker Creek Design, Addendum No. 1,* prepared for the USEPA and USACE. July 12, 1996. (Includes application of ICP barrier at CTP.)

Bunker Creek (Section 4.3.9)

Spectrum Engineering, 1996. *Draft Report. Bunker Creek and Government Gulch Flood Hydrology,* prepared for TerraGraphics and the State of Idaho. March 20, 1996.

CH2M HILL, Inc. 1996a. *Bunker Creek Design,* prepared for the USEPA and USACE. July 3, 1996.

CH2M HILL, Inc. 1996b. *Bunker Creek Design, Addendum No. 1,* prepared for the USEPA and USACE. July 12, 1996

Union Pacific Railroad Rights-of-Way (Section 4.3.10)

Applied Geotechnology Inc. and USPCI. *Study of Lead Contamination Along the Union Pacific Railroad Right-of-Way*. Prepared for the Union Pacific Railroad Company by Applied Geotechnology Inc. and USPCI, 1991.

McCulley, Frick, and Gilman, Inc. *1997 Annual Remedial Action Implementation Plan for Remedial Actions Along the Union Pacific Railroad Right-of-Way*. Prepared for Union Pacific Railroad Company by McCulley, Frick, and Gilman, Inc., April 1997.

McCulley, Frick, and Gilman, Inc. *Bunker Hill Superfund Site Union Pacific Area Remedial Action Work Plan*. Prepared for Union Pacific Railroad Company by McCulley, Frick, and Gilman, Inc., March 1995.

McCulley, Frick, and Gilman, Inc. *Letter Report for Submittal of Sampling Results for Union Pacific Area 5-Yr. Review Rights-of-Way Sampling at the Bunker Hill Superfund Site*. Prepared for Union Pacific Railroad Company by McCulley, Frick, and Gilman, Inc., June 22,1999.

Peterson, Scott. Idaho State Department of Environmental Quality. Telephone interview to obtain information regarding remediation of areas of the UPRR by the Agencies and verification sampling and testing. February 2, 2000.

Newly Promulgated or Revised Regulatory Standards (Section 5.1)

American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices*. 1999.

U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control. "Preventing Lead Poisoning in Young Children." October 1991.

U.S. Environmental Protection Agency. Guidance Concerning Soil Lead Cleanup Levels at Superfund Sites. OSWER 9355.4-02. September 1989.

U.S. Environmental Protection Agency. *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*. February 1994. (NTIS #PB93-963510, OSWER #9285.7-15-1).

U.S. Environmental Protection Agency. Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 0.99d (NTIS #PB94-501517, OSWER #9285.7-15-2).

U.S. Environmental Protection Agency. Memorandum Titled: Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. EPA 540-F-98-030. OSWER 9200.4-27. August 1998.

U.S. Environmental Protection Agency. Memorandum Titled: Proposed TSCA 403 Soil Lead Hazard and OSWER's Lead-in-Soils Policy. EPA 540-F-98-061. OSWER 9200.4-29. December 1, 1998.

U.S. Environmental Protection Agency. *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*. December 1996.

U.S. Environmental Protection Agency. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. EPA 540-F-94-043. OSWER 9355.4-12. August 1994.

U.S. Environmental Protection Agency. *Technical Support Document for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*. December 1994. [NTIS #PB94-963505, OSWER #9285.7-22]

U.S. Environmental Protection Agency. *Validation Strategy for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*. December 1994.

Appendix A

Appendix A
Identification of Newly Promulgated or Revised Regulatory Standards

Chemical-Specific Standards

A. Air – Potentially Applicable Requirements

<u>Revised</u>

National Ambient Air Quality Standards (40 CFR Part 50) – The health- and welfare-based standards for particulate matter (measured as PM_{10}, particles that are 10 micrometers in diameter or smaller) enforced at the time of the ROD were promulgated in 1987. They were (1) a 24-hour standard set at 150 micrograms per cubic meter ($\mu g/m^3$), and (2) an annual 24-hour standard set at 50 $\mu g/m^3$. Since these PM_{10} standards were established, a large number of important new studies have been published on the health effects of particulate matter. Many of these studies suggest that significant adverse health effects occur at concentrations below the previous standards. On July 17, 1997, EPA revised the coarse particulate matter (particles with diameters less than 10 μm or PM_{10}) 24-hour standards of 150 $\mu g/m^3$ to protect against short-term exposure to coarse fraction particles. The approach now used is thought to provide a more stable target for control programs and eliminates the need for complex data handling for missing values. In addition, two new $PM_{2.5}$ (particles with less than 2.5 μm) standards were added, set at 15 μg/m3, based on the 3-year average of annual arithmetic mean $PM_{2.5}$ concentrations, and 65 $\mu g/m^3$, based on the 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations. EPA has concluded that fine particles ($PM_{2.5}$) are better surrogates for those components of particulate matter most likely linked to mortality and morbidity effects at levels below the previous standards (PM_{10} standards).

These new regulations are currently under judicial review as a result of court challenges and therefore, are still subject to change.

B. Soil and Dust – Potential To Be Considered Materials

<u>Revised</u>

Center for Disease Control's (CDC) Statement on Childhood Blood Levels (October 1, 1991) – In the fourth revision of the Statement on Preventing Lead Poisoning in Young Children dated October 1, 1991, CDC's Advisory Committee on Childhood Lead Poisoning Prevention stated that new data indicate significant adverse effects of lead exposure in children at blood lead levels much lower than previously believed to be safe. Some adverse health effects have been documented at blood lead levels at least as low as 10 μg/dL. As a result, the 1985 intervention level of 25 μg/dL was revised downward to 10 μg/dL.

Table A-1
Summary of Newly Promulgated or Revised Standards

Media/ Change Status	Category/ Regulation	Entity	Citation	Prerequisite	Requirement	Location
Chemical-Specific Standards						
Air	**Potentially Applicable Requirement**					
Revised	Clean Air Act National Ambient Air Quality Standards(NAAQS)	Federal	42 U.S.C. Section 7401 et seq.; 40 CFR Part 50	Establishes ambient air quality standards for emissions of chemicals and particulate matter.	Emissions of particulates and chemicals that occur during remedial activities will meet the applicable NAAQS that are as follows: Particulate Matter as PM_{10}, (particles with diameters <= 10 µ meters): 150 µg /m^3 24-hour average concentration, 50 µg/m^3 annual arithmetic mean $PM_{2.5}$ (particles with diameters <= 2.5 µ meters): 65 µg /m^3 24-hour average concentration, 15 µg/m^3 annual arithmetic mean Lead: 1.5 µg Pb/m^3 Quarterly arithmetic mean	Site-Wide
Soil and Dust	**Potential To Be Considered Materials**					
Revised	Advisory Committee on Childhood Lead Poisoning Prevention	Federal	Centers for Disease Control's statement on Preventing Lead Poisoning in Young Children, 1991	Removal of contaminated soils	New data indicate significant adverse effects of lead exposure in children at blood lead levels lower than previous believed to be safe. The 1985 intervention level of 25 µg/dL is, therefore, revised downwards to 10 µg Pb/dL.	Site-Wide

Table A-1
Summary of Newly Promulgated or Revised Standards

Media/ Change Status	Category/ Regulation	Entity	Citation	Prerequisite	Requirement	Location
Revised	Revised U.S. EPA Interim Soil Lead Guidance for CERCLA Sites	Federal	OSWER Directive #9355.4-12, August 1994	Establishes a streamlined approach for determining protective levels for lead in soil	This revised guidance document recommends a 400 ppm screening level for lead in soil, describes how to develop site-specific preliminary remediation goals (PRGs), and describes a strategy for management of lead contamination that have multiple sources of lead. The screening level for lead was calculated using the Integrated Exposure Uptake Biokinetics Model IEUBK. A typical child exposed to soil lead level of 400 ppm would have an estimated risk of no more than 5% exceeding the 10 µg Pb/dL blood lead level.	Site-Wide
New	U.S. EPA Clarification to1994 Interim Soil Lead Guidance for CERCLA Sites	Federal	OSWER Directive #9200.4-27P (August 1998)	Establishes a streamlined approach for determining protective levels for lead in soil	Clarified the existing 1994 Soil-lead directive to promote national consistency in decision-making at CERCLA sites.	Site-Wide
Surface Water	**Potentially Applicable Requirement**					
Revised	Clean Water Act – FWQC	Federal	40 CFR Part 131	Establishes acceptable contaminant levels for ingestion of aquatic organisms and for intake by aquatic organisms in surface water	FWQC for antimony, arsenic, beryllium, cadmium, copper, lead, zinc, mercury, and PCBs	Onsite source contributions only and SFCDR tributaries onsite

Table A-1
Summary of Newly Promulgated or Revised Standards

Media/ Change Status	Category/ Regulation	Entity	Citation	Prerequisite	Requirement	Location
Surface Water	**Potential Relevant and Appropriate Requirement**					
New	Water Quality Standards and Wastewater Treatment Requirements	State	IDAPA §§16.01.02	Restrictions placed on the discharge of wastewater *and on human activities* that may adversely affect water quality in the waters of the state. Establishes *numeric criteria for toxic* substances for the protection of human health and aquatic life. Incorporates by reference 40 CFR 131.36.	Requires protection of State waters for appropriate beneficial uses; establishes *State water quality standards for* bacteria, dissolved oxygen, pH, temperature, dissolved gas and total ammonia.	Onsite source contributions only and SFCDR tributaries onsite
Surface Water	**Potential To Be Considered Materials**					
New	Total Maximum Daily Load (TMDL) for the Coeur d'Alene Basin	Federal and State Joint	Draft Technical Support Document, TMDL for Dissolved Cd, Pb, Zn in Surface Waters of the Coeur d'Alene Basin (April, 1999)	Discharge of lead, cadmium, and zinc into the surface waters of the CDA basin	Establishes total maximum daily load elements including water quality standards, loading capacity, natural background, loads, gross allocations, waste load allocation, load allocations, and margin of safety.	Site-Wide
Action-Specific Standards; Potentially Applicable Requirements						
New	Air contaminants	Federal	29 CFR 1910.1000	Releases of airborne contaminants during remedial activities.	The remedial action will be conducted in a manner such that the remedial workers' exposure to air contaminants will not exceed the 8 hour time-weighted values given below in any 8-hour work shift of a 40-hour work week	Site-Wide

Table A-1
Summary of Newly Promulgated or Revised Standards

Media/ Change Status	Category/ Regulation	Entity	Citation	Prerequisite	Requirement	Location
Revised	Threshold Limit Values (TLVs)	Federal	Established by American Conference of Governmental Industrial Hygienists (ACGIH), 1999.	Release of airborne contaminants during remedial activities.	TLVs are based on time weighted average (TWA) exposure to an airborne contaminant over an 8-hour work day or a 40 hour work week. Identify levels of airborne contaminants with which health risks may be associated.	Site-Wide

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
Air	Clean Air Act – National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Particulate Matter as PM_{10}, (particles with diameters <= 10 μ meters) $PM_{2.5}$ (particles with diameters <= 2.5 μ meters): Lead	150 μg /m³ 24-hour average concentration, 50 μg/m³ annual arithmetic mean 65 μg /m³ 24-hour average concentration, 15 μg/m³ annual arithmetic mean 1.5 μg Pb/m³ Quarterly arithmetic mean.	PM_{10} and $PM_{2.5}$ currently under judicial review, subject to change.
Soil and Dust	Revised U.S. EPA Interim Soil Lead Guidance for CERCLA Sites	OSWER Directive #9355.4-12, August 1994	Lead	400 ppm	For a typical child, the 400 ppm soil lead level corresponds to an estimated risk of no more than 5% exceeding the 10 ug/dl blood lead level using the IEUBK model.
Groundwater	Safe Drinking Water Act - MCLs	40 CFR 141	Arsenic Copper (at tap) Lead (at tap) Mercury PCBs Selenium Silver Zinc Nitrate	0.05 mg/L 1.3 mg/L (Action Level) 0.015 mg/L (Action Level) 0.002 mg/L 0.0005 mg/L 0.05 -- -- 10 mg/L	October 1996 drinking water regulations and Health Advisories by Office of Water, USEPA.

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
Groundwater	Safe Drinking Water Act – MCLGs	40 CFR 141	Arsenic	--	October 1996 drinking water regulations and Health Advisories by Office of Water, USEPA.
			Copper (at tap)	1.3 mg/L	
			Lead (at tap)	zero	
			Mercury	0.002 mg/L	
			PCBs	zero	
			Selenium	0.05 mg/L	
			Silver	--	
			Zinc	--	
			Nitrate	10 mg/L	
Surface Water	Water Quality Standards – Freshwater Quality Standards, chronic	40 CFR 131.36	Antimony	--	*Freshwater aquatic life criteria for these metals are a function of hardness and water effect ratio. Criteria presented are dissolved metal and correspond to a total hardness of 100 mg/L and a water effect ratio of 1.0. Mercury criterion listed is for total recoverable. PCB criterion listed is for individual PCBs.
			Arsenic	190 ug/L	
			Beryllium	--	
			Cadmium*	1.0 ug/L	
			Copper*	11 ug/L	
			Lead*	2.5 ug/L	
			Zinc*	100 ug/L	
			Mercury	0.012 ug/L	
			PCBs	0.014 ug/L	

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
Surface Water	Water Quality Standards – Human health criteria for consumption of organisms	40 CFR 131.36	Antimony	4300 ug/L	PCB criterion listed is for individual PCBs.
			Arsenic	0.14 ug/L	
			Beryllium	--	
			Cadmium	--	
			Copper	--	
			Lead	--	
			Zinc	--	
			Mercury	0.15 ug/L	
			PCBs	0.000045 ug/L	
Surface Water	National Recommended Water Quality Criteria – Freshwater Quality Standards, chronic	FR 63 No. 234, December 7, 1998 and FR 64 No. 77, April 22, 1999	Antimony	--	*Freshwater aquatic life criteria for these metals are a function of hardness in the water column. Criteria presented are dissolved metal and correspond to a total hardness of 100 mg/L. Mercury criterion listed is for total recoverable.
			Arsenic	150 ug/L	
			Beryllium	--	
			Cadmium*	2.2 ug/L	
			Copper*	9.0 ug/L	
			Lead*	2.5 ug/L	
			Zinc*	120 ug/L	
			Mercury	0.77 ug/L	
			PCBs	0.014 ug/L	

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
Surface Water	National Recommended Water Quality Criteria – Human health criteria for consumption of organisms	FR 63 No. 234, December 7, 1998 and FR 64 No. 77, April 22, 1999	Antimony Arsenic Beryllium Cadmium Copper Lead Zinc Mercury PCBs	4300 ug/L 0.14 ug/L -- -- 1300 ug/L -- 69000 0.051 ug/L 0.00017 ug/L	Copper value is not available for consumption of organisms. Value presented is for consumption of water and organisms. PCB criterion listed is for individual PCBs.
Surface Water	Idaho Water Quality Standards – Water designated for aquatic life use – Freshwater Criteria	IDAPA 16.01.02.210	Antimony Arsenic Beryllium Cadmium* Copper* Lead* Zinc* Mercury PCBs	-- 50 ug/L -- 1.0 ug/L 11 ug/L 2.5 ug/L 100 ug/L 0.012 ug/L 0.014 ug/L	Idaho water quality standards incorporate toxic substance criteria set forth in 40 CFR 131.36(b)(1) with exception of arsenic that is 50 ug/L. Freshwater quality standards and human health criteria for ingestion of organisms are incorporated by reference for waters designated for aquatic life use. *Freshwater aquatic life criteria for these metals are a function of hardness and water effect ratio. Criteria presented are dissolved metal and correspond to a total hardness of 100 mg/L and a water effect ratio of 1.0. Mercury criterion listed is for total recoverable. PCB criterion listed is for individual PCBs.

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
Surface Water	Idaho Water Quality Standards – Water designated for recreation use – Human health criteria for ingestion of organisms	IDAPA 16.01.02.210	Antimony Arsenic Beryllium Cadmium Copper Lead Zinc Mercury PCBs	4300 ug/L 50 ug/L -- -- -- -- -- 0.15 ug/L 0.000045 ug/L	Idaho water quality standards incorporate toxic substance criteria set forth in 40 CFR 131.36(b)(1) with exception of arsenic that is 50 ug/L. Human health criteria for ingestion of organisms are incorporated by reference for waters designated for recreation use. Water designated for aquatic life use are incorporated by reference PCB criterion listed is for individual PCBs.
Surface Water	Total Maximum Daily Load (TMDL) for the Coeur d'Alene Basin	Draft Technical Support Document, TMDL for Dissolved Cd, Pb, Zn in Surface Waters of the Coeur d'Alene Basin (April, 1999)	Dissolve Cadmium Dissolved Lead Dissolved Zinc	0.38 ug/L 0.54 ug/L 32 ug/L	Values established based on EPA's 1995 National Toxics Rule. Freshwater chronic criterion calculated at hardness of 25 mg/L.
Air	OSHA - Toxic and Hazardous Substances Exposure for Remedial Workers at Hazardous Waste Sites	29 CFR 1910.1000	Antimony Arsenic Cadmium Copper Lead	500 $\mu g/m^3$ 10 $\mu g/m^3$ (Permissible exposure level per 29 CFR 1910.1018) 5 $\mu g/m^3$ (Permissible exposure level per 29 CFR 1910.1027) fume = 100 $\mu g/m^3$ dust = 1,000 $\mu g/m^3$	

Table A-2
New or Revised Numeric Standards

Media	Regulation	Citation	Analyte	Concentration	Comments
				50 µg/m³ (Permissible exposure level per 29 CFR 1910.1025)	
			Mercury	Alkyl = 10 µg/m³ Except Alkyl: vapor = 50 µg/m³ inorganic = 100 µg/m³	
			Zinc	ZnCl = 1,000 µg/m³ Zinc Oxide: fume = 5,000 µg/m³ dust = 15,000 µg/m³ Resipirable fraction = 5,000 µg/m³	
Air	Threshold Limit Values (TLVs)	Established by American Conference of Governmental Industrial Hygienists (ACGIH), 1999.	Antimony and compounds	0.5 mg/m³	
			Arsenic	Elemental and inorganic compounds 0.01 mg/m³	
			Cadmium	Elemental and compounds 0.01 mg/m³, respirable fraction 0.002 mg/m³	
			Copper	Fume 0.2 mg/m³, Dusts & mists 1 mg/m³	
			Lead	Elemental and inorganic compounds, 0.05 mg/m³	
			Mercury	Alkyl compounds 0.01 mg/m³, aryl compounds 0.1 mg/m³, inorganic forms 0.025 mg/m³	
			Zinc	Zinc chloride fume 1 mg/m³, zinc oxide fume 5 mg/m³, zinc oxide dust 10 mg/m³	

Revised

Revised U.S. EPA Interim Soil Lead Guidance for CERCLA Sites (OSWER Directive 9355.4-12, July 14, 1994)--The 1994 OSWER directive established OSWER's approach to addressing lead in soil at CERCLA and Resource Conservation and Recovery Act (RCRA) sites. It established a streamlined approach for determining protective levels for lead in soil as follows:

- recommends a 400 mg/kg screening level for lead in soil in residential properties;
- describes how to develop site-specific preliminary remediation goals (PRGs) and media cleanup standards (MCSs),
- describes strategy for management of lead contamination at sites that have multiple sources of lead.

A previous soil lead OSWER Directive (September 1989) recommended a soil lead cleanup level of 500-1,000 mg/kg for protection of human health at residential CERCLA sites (OSWER Directive #9355.4-02). The current recommended residential screening level for lead of 400 mg/kg is calculated with the Integrated Exposure Uptake Biokinetic Model (IEUBK) model (Pub #9285.7-15-2, PB93-963511), using default parameters. EPA recommends that residential PRGs for CERCLA sites can be developed using the IEUBK model on a site-specific basis, where site data support modification of model default parameters.

In developing lead PRGs for CERCLA sites, EPA recommends that a soil lead concentration be determined so that a typical child or group of children exposed to lead at this level would have an estimated risk of no more than 5 percent of exceeding a blood lead level of 10 µg/dL, which corresponds to a soil lead level of 400 mg/kg using the IEUBK model.

The 1994 interim directive superceded all previous directives on soil lead cleanup for CERCLA and RCRA programs. As such, the soil lead remedial goals at Bunker Hill site may need to be adjusted downward to 400 mg/kg.

New

Clarification to 1994 Revised Interim Soil Lead Guidance for CERCLA Sites (OSWER Directive 9200.4-27P, August 1998) – This directive clarified OSWER's 1994 policy on (1) using the IEUBK model and blood lead level studies that were reviewed by EPA's Science Advisory Board, (2) determining the geographic area to use in evaluating human exposure to lead contamination, (3) addressing multimedia lead contamination, and (4) determining appropriate response actions at lead sites. The purpose for clarifying the existing 1994 directive is to promote national consistency in decision-making at CERCLA and RCRA lead sites across the country.

C. Groundwater and Surface Water – Potentially Applicable Requirements

Revised

Water Quality Standards (40 CFR Part 131.36) – The water quality standards define the water quality goals of a water body by designating the use or uses to be made of the water and by setting criteria necessary to protect the uses. The criteria for priority toxic pollutants have been revised including the human health criteria for the consumption of organisms in surface water and the fresh water quality criteria. The analytes listed in the 1992 ROD include antimony, arsenic, beryllium, cadmium, copper, lead, zinc, mercury, and PCBs.

D. Groundwater and Surface Water – Potential Relevant and Appropriate Requirements

New

National Recommended Water Quality Criteria (FR 63, No. 234, December 7, 1998)--The national recommended water quality criteria developed pursuant to section 304(a) of the Clean Water Act were published in the Federal Register (December 7, 1998; FR Vol. 63 No. 234). The criteria were subsequently republished (April 1999; FR Vol. 64 No. 77,). These criteria are not regulations, and do not impose legally binding requirements on the states. However, the states are expected to adopt the new or revised numeric water quality criteria into their standards within 5 years from the date of EPA's publication of these criteria. For this reason, these criteria are considered as potentially relevant and appropriate.

New

State of Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 16.01.02)--The Department of Health and Welfare of the State of Idaho promulgated rules governing water quality standards in July of 1993. The rules designate uses that are to be protected in and of the waters of the state and establish standards of water quality protection for those uses. In November of 1999, the State Board of Health and Welfare adopted significant revisions to the water quality standards. The revisions are currently pending review by the 2000 Idaho State Legislature for final approval. Changes include addition of new aquatic life beneficial uses and criteria, and revision of recreation beneficial uses and criteria.

With certain exceptions, the toxic substance criteria set forth in the National Toxics Rule (40 CFR 131.36(b)(1)), is incorporated by reference in the 2000 Idaho State Water Quality Standards (IDAPA 16.01.02.210). In particular, freshwater aquatic life and human health criteria for consumption of organisms of the National Toxics Rule were incorporated by reference for waters designated for aquatic life use. Criteria based on human health for consumption of organisms were incorporated by reference for waters designated for recreation use. Since most of the water body units within the SFCDR basin were designated for both recreational and aquatic life uses (IDAPA 16.01.02.110), chronic aquatic life water quality criteria and human health criteria for ingestion of organisms may be considered as potential ARARs. This would be a departure from the 1992 ROD that states that attainment of chronic aquatic life water quality criteria in the SFCDR under the Clean Water Act is not an ARAR with respect to the remedial action.

The anticipated effective date of the revised regulations is March 2000.

E. Groundwater and Surface Water – Potential To Be Considered Materials

Added

Draft Technical Support Document, Total Maximum Daily Load (TMDL) for Dissolved Cadmium, Dissolved Lead, and Dissolved Zinc in Surface Waters of the Coeur d'Alene Basin (April 1999)--In September 1996, the U.S. District Court for the Western District of Washington ordered EPA and the State of Idaho to develop a schedule for completing TMDLs for all streams identified by the State of Idaho in its 1994 Section 303(d) list. In a letter dated February 26, 1999, the State of Idaho proposed that EPA and the State jointly issue a TMDL for the Coeur d'Alene Basin. EPA and the State of Idaho jointly issued the Draft Technical Support Document (April 1999). It describes the information assembled and analyzed to develop the TMDL, including applicable water quality standards (freshwater aquatic life criteria), available water quality and flow data, calculation methods, legal and policy considerations, and implementation mechanisms. The proposed TMDL would establish loading capacities, waste load allocations, load allocation, background conditions, and a margin of safety in accordance with 40 CFR 130.

For cadmium, lead and zinc in the dissolved form in the water column, the water quality criteria designed to protect aquatic life from chronic exposure effects are the most stringent criteria that apply to waters in the Coeur d'Alene Basin. TMDLs for these metals values are established based on EPA's 1995 National Toxics Rule. Using an average hardness of 25 mg/L, the chronic criteria for dissolved cadmium, lead, and zinc values are calculated to be 0.38 µg/L, 0.54 µg/L and 32 µg/L respectively. These metals parameters are considered the highest priority for TMDL development. They are also among the primary contaminants of concern at the Bunker Hill site.

If the draft TMDL is consistent with the statute and EPA's implementing regulations, EPA will approve the TMDL. Until its final approval, the Coeur d'Alene TMDL is considered as potential to be considered material.

Action-Specific Standards

A. Potentially Applicable Requirements

New

Occupational Safety and Health Act (OSHA)-Toxic and Hazardous Substances (29 CFR 1910.1000)--Remedial workers' exposure to toxic and hazardous substances will not exceed the 8-hour time-weighted values given in 29 CFR 1910.1000 in any 8-hour work shift of a 40-hour work week. This regulation is considered as potentially applicable.

<u>**Revised**</u>

Threshold Limit Values (TLVs) (1999)--The TLVs refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers **may** be repeatedly exposed without adverse health effects. The TLVs, which are established by the American Conference of Governmental Industrial Hygienists (ACGIH), are revised on regular basis as new information on health risks becomes available. The latest TLVs were published in 1999 by ACGIH.

Appendix B

Appendix B
Bunker Hill Hillsides Project Purpose, Goals, and Objectives

The tables below were excerpted from the *Bunker Hill Hillsides Revegetation Conceptual Plan and Monitoring Plan* (CH2M HILL 1999). This information forms the basis for hillsides project design and long-term monitoring of hillsides treatments. Performance standards listed in Table B-2 are interim in nature. Monitoring results will be reviewed by the interagency project team for consistency with project and ROD goals prior to acceptance as final standards.

Table B-1
Bunker Hill Hillsides Project Purpose, Goals, and Objectives

Purpose   Improve the condition and safety of the human and natural environment which have been impaired by actual or threatened releases of hazardous substances from this site in the Silver Valley, Idaho, through the implementation of selected response actions for the hillsides.
Goals   1. Improve watershed function by reducing runoff, soil erosion, and transport of pollutants within and from the site.   2. Establish adapted plant communities capable of natural regeneration and providing ecological and/or societal values.
Objectives   1. Establish herbaceous cover on sites with less than 50 percent cover with priority to areas with high contaminant levels and/or sites with less than 25 percent cover.   2. Establish check dams in gullies and on terraces.   3. Establish herbaceous and woody vegetation in gullies and on terraces.   4. Ameliorate soil physical and chemical constraints to watershed function and plant growth.   5. Reduce runoff from terraces.   6. Establish self-regenerating species and, where needed, soil-building species.   7. Minimize colonization by noxious weeds.   8. Manage the Bunker Hill hillsides using adaptive management techniques.

Table B-2
Bunker Hill Hillsides Project Interim Performance Standards

Interim Performance Standard #1

Herbaceous plant canopy cover of regeneration species shall exceed 50 percent within each planting area designated in each task order specification within two (2) full growing seasons after installation. Actual determination of canopy cover will be measured on each 5-acre management unit block. Any management unit with less than 50 percent cover will be evaluated further to determine the appropriate course of action including, but not limited to, reseeding, addition of soil amendments, lime, or fertilizer, or additional monitoring to determine rate of cover expansion.

Interim Performance Standard #2

Check dams, built and installed as specified, shall be constructed in all major gullies and adjacent to major gullies on terraces. Each check dam shall be inspected following precipitation events (including rain, rain-on-snow, and specific snowmelt events) sufficient to cause sheet erosion runoff from the barren hillsides. The inspection shall determine if each check dam is retarding or retaining water flow by ensuring that water is not bypassing or "short-circuiting" each check dam. Any check dam exhibiting short-circuiting of water shall be repaired immediately. Monitoring shall continue within each gully-check dam system until Objective 3 (as measured by Performance Standard #3 below) is achieved for that gully.

Interim Performance Standard #3

Vegetation cover of regeneration species shall exceed 70 percent of each major gully bottom and terrace within two (2) full growing seasons after completion of installation.

Interim Performance Standard #4

4A. Within five (5) years after completion of plant establishment projects, the following ratios of runoff volume to precipitation shall decrease:

- Runoff volume to precipitation (per annual monitoring period)
- Hourly runoff volume to hourly rainfall intensity

4B. Water quality of discharges is within Bunker Hill project targets for heavy metals, and turbidity decreases within five (5) years after completion of plant establishment projects.

Interim Performance Standard #5

Water shall not flow from the terraces into major gullies with sufficient energy to initiate sediment transport and down-cutting, but shall instead be retained or retarded until it infiltrates, evaporates, or slowly discharges onto the hillsides. The check dams shall also not result in any terrace being breached due to operation of the check dams. This shall apply to the vicinity of check dams only and until such time as vegetation becomes established and stops sediment movement. This would be observed during rain and/or snowmelt events of sufficient intensity to cause sheet runoff from barren hillsides.

Table B-2
Bunker Hill Hillsides Project Interim Performance Standards

Interim Performance Standard #6

Evidence of regeneration of site species must be present on at least 50 percent of each management unit within 3 years following execution of a given Task Order. Evidence of potential for regeneration includes but is not limited to one or more of the following:

1. Seed production of onsite plant species and presence of newly germinated seed. The presence of newly germinated seed must be linked to on-site seed production from existing plant species (either artificially planted or naturally invading from surrounding areas) to ensure that newly germinated seed did not arise from previous seeding operations and/or a short-term invasion from offsite species.
2. Expansion of cover by vegetative production of new shoot growth from rhizomes or other underground structures.
3. Evidence of sprouting from damaged or cut stems of woody species.

Interim Performance Standard #7

1. Comply with State of Idaho Noxious Weed regulations.

Interim Performance Standard #8

1. Use information derived from the Monitoring Program in an iterative fashion to determine the effectiveness, utility, and validity of each of the performance standards in the project.